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OFFSHORE TRANSPORT AND DIFFUSION IN THE LOS ANGELES BIGHT - I, --ETC(U)
1980 G E SCHACHER, K L DAVIDSON
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NAVAL POSTGRADUATE SCHOOL
Monterey, California

1980

OFFSHORE TRANSPORT AND DIFFUSION IN THE
LOS ANGELES BIGHT - I, NPS DATA SUMMARY

G.E. Schacher, K.L. Davidson
and C.A. Leonard
D.E. Spiel and C.W. Fairall

Environmental Physics Group
Naval Postgraduate School
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Prepared for: Outer Continental Shelf Division
Bureau of Land Management
Los Angeles, California 90017

NAVAL POSTGRADUATE SCHOOL
Monterey, California

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Meteorological measurements have been made in support of offshore transport and diffusion experiments in the Los Angeles Bight area. This report presents the meteorological data, reduced to values which can be used in assessing current transport models.

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I. Introduction

During September of 1980 the Environmental Physics Group of the Naval Postgraduate School (NPS) and Aerovironment, Inc. conducted a research program in the Santa Barbara Channel area of the California coast. The purpose of the operation was to perform offshore tracer experiments in order to parameterize dispersion models that are in current use and to build a data base for future model development. The purpose of this report is to present the pertinent meteorological and source data for use by those who will be involved in the modeling effort. Only the basic data, reduced to engineering units, will be presented here; interpretation of these data and application to the models will be the subject of a future joint report by Aerovironment and NPS.

Although the data gathered in this experiment has much wider application, it was collected for the specific purpose of parameterizing models that will be used to assess the onshore impact of offshore oil exploration and production sites. Such impact currently has great importance since many coastal areas are near the legal air pollution limit and any significant additional loading could push them over the limit. Air pollution models in current use have not been adequately validated for the overwater regime. The results of this study should remedy the inadequacy of the models.

During the tracer experiments SF_6 gas was released from the ship RV/Acania and tracked by an aircraft, a small boat, and one mobile and fixed stations on shore. Meteorological data was gathered on the ship and on the shore. This report contains shipboard meteorological - data and gas source strength. Shore meteorological data and tracer results can be found in a report by Aerovironment.

II. Ship Operation Scenario

Since the impact of offshore sources on the shore is the purpose of these investigations the experiments must be performed during periods of onshore winds. These winds must be of a fairly long duration since it takes a minimum of 6 hours to gather enough data during any one experiment. The preliminary decision to release the tracer gas on any given day must be made on the previous day due to the time needed to prepare all of the sampling sites. Thus, the following schedule was used.

All Days

1. 0800-1200-2000: radio shipboard meteorological data to shore.
2. 1000: Shore obtains weather forecast from Point Mugu.
3. 1200: shore command center makes a go/no-go decision for a release on the following day.

Release Day

4. 0700: begin hourly wind reports to shore.
5. 1000: decision on release made by ship-shore communication, final decision made on shore.
6. Final positioning of ship.
7. 1100: start tracer gas release.
8. 1900: end tracer gas release and hourly wind reports.

The exact timing of the release varied somewhat and was two hours later for one of the tests because of wind conditions.

Because of difficulty in moving the shore stations, targeting of the plume was accomplished by moving the ship. This had to be done before the release was begun because moving the ship would introduce wander into the plume trajectory and contaminate the results. In order to hold the ship stationary to the degree needed it was anchored during a release.

Significant Events:

At times the ship was peforming tasks not directly associated with this study or was in port. As an aid in interpreting the data we list times of "significant shipboard events".

9/21	0905	Underway from Monterey
9/22	1030	Arrive at operation area
	1225	Underway to Anacappa Island
	1400-1700	Drift in Anacappa passage
	1700	Move to open channel
	1930	On station at operation area
9/25	1000	Underway for Port Hueneme
	1118	Dock
9/27	0500	Underway
	0640	Arrive at operation area
9/28	1930	Underway for Port Hueneme
	2030	Dock
9/29	0500	Underway
	0615	Arrive at operation area
	1930	Underway for Port Hueneme
	2030	Dock
9/30	1015	Underway
10/1	1010	Arrive at operation area
	1630	Depart for Monterey

Table 1 - Significant Shipboard Events

III. Shipboard Equipment

We give here a brief description of the meteorological measurements that were made on the ship. Details of the equipment and calibration procedures can be found in a previous report. Two meteorological stations at heights of 7 m and 20.5 m above mean sea level were used. At each level the following parameters were measured:

relative wind speed

relative wind direction (upper level only)

air temperature

dew point

wind speed fluctuation

The following parameters were also measured:

sea surface temperature

ship roll

ship location

inversion height

temperature and humidity profiles to 5,000 ft.

sky cloud cover

The temperature and humidity profiles were obtained by shipboard radiosonde launch and were taken every 12 hours. The temperature inversion height was determined by an acoustic sounder which gave a continuous strip chart record. Most data listed above was averaged for one half hour intervals. The exceptions were relative wind direction and ships roll. For both, 10 sec averages were obtained and recorded for the full period of a gas release.

IV. Tracer Release Data

Four separate experiments were performed. For each the gas was released through the exhaust of one of the ship's diesel motors. The main engine was used first but the cool gas injection caused a slight crack in the exhaust pipe so the exhaust of one of the motor generator sets was used for subsequent releases. Both exhausts are inclined at an angle of 45° above the horizontal. Both engines are 2 cycle diesels so exhaust flow rate is obtained by multiplying 2/3 times the displacement times the revolutions per minute. The pertinent data to characterize plume rise are:

Release Numbers	rpm	displacement (Cu in)	Stack Temp. (°F)	Flow Rate (cu in/sec)	Diameter (in)
1	1250	860	210	9.17×10^3	8
2,3,4	1500	426	250	7.13×10^3	4.5

Table 2. Characteristics of exhausts used during tracer gas releases.

For a release, 4 tanks of SF_6 were connected to a single manifold. The manifold has a pressure gauge and two rotometers, one supplied by the manufacturer and one calibrated and supplied by Aerovironment. The second meter was used to set the flow rate the first to monitor it since it was less subject to fluctuations. The gas pressure to the rotometers was maintained at 25 lbs/in^2.

Using the data found in Table 3 the flow rates for the four releases were

Release 1	49.01	lbs/hr
Release 2	50.74	lbs/hr
Release 3	48.54	lbs/hr
Release 4	47.91	lbs/hr

During the releases the ship was anchored approximately 5 Nmi SWW of Ventura. As stated above the releases started at approxi mately 1100 and ended at approximately 1900. The exact times and locations are given in Table 3.

Release	Date	Latitude	Longitude	Start Time	End Time
1	9/24	34°14.2'N	119°21.1'W	1135	1900
2	9/27	34°14.8'N	119°21,1'W	1107	1815
3	9/28	34°14.2'N	119°21.1'W	1243	1900
4	9/29	34°12.8'N	119°20.4'W	1143	1900

Table 4. Exact locations and start and end times for each release. Times are local, Pacific Daylight Time.

Bottle Number	Initial Weight (lbs)	Release 1	Release 2	Weight after Release 3	Release 4
1	255	164			
2	256	166			
3	252	159.5			
4	254	164	140.5		
5	257.5		145		
6	253		141		
7	253		139		
8	278				
9	260.5				
10	256.5			158.5	
11	256			152.5	
12	255			151.5	
13	257				144
14	254				140
15	251.5				139
16	257				247.5
Release time		7:25	7:08	6:17	7.17

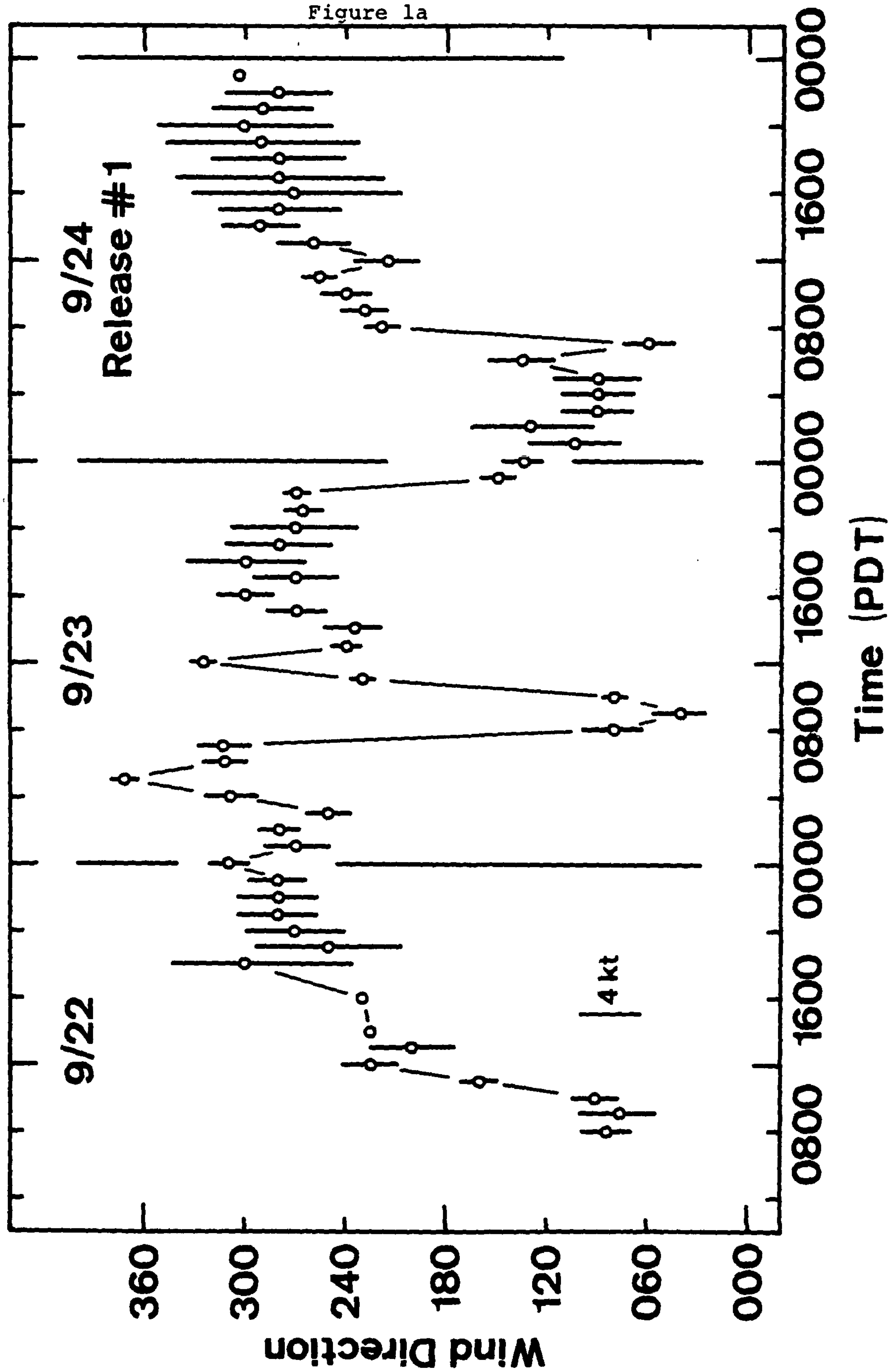
Table 3. SF_6 bottle weights before and after the four releases. The total times for each release are also given.

V. Wind Histories

Recent histories of wind direction and speed can be very useful for predicting winds on a short term basis as long as the synoptic situation does not change. For this operation winds were recorded and plotted at least every hour in the experimental area. These plots, shown in Figures 1, were very useful in the go/no-go decisions for release days.

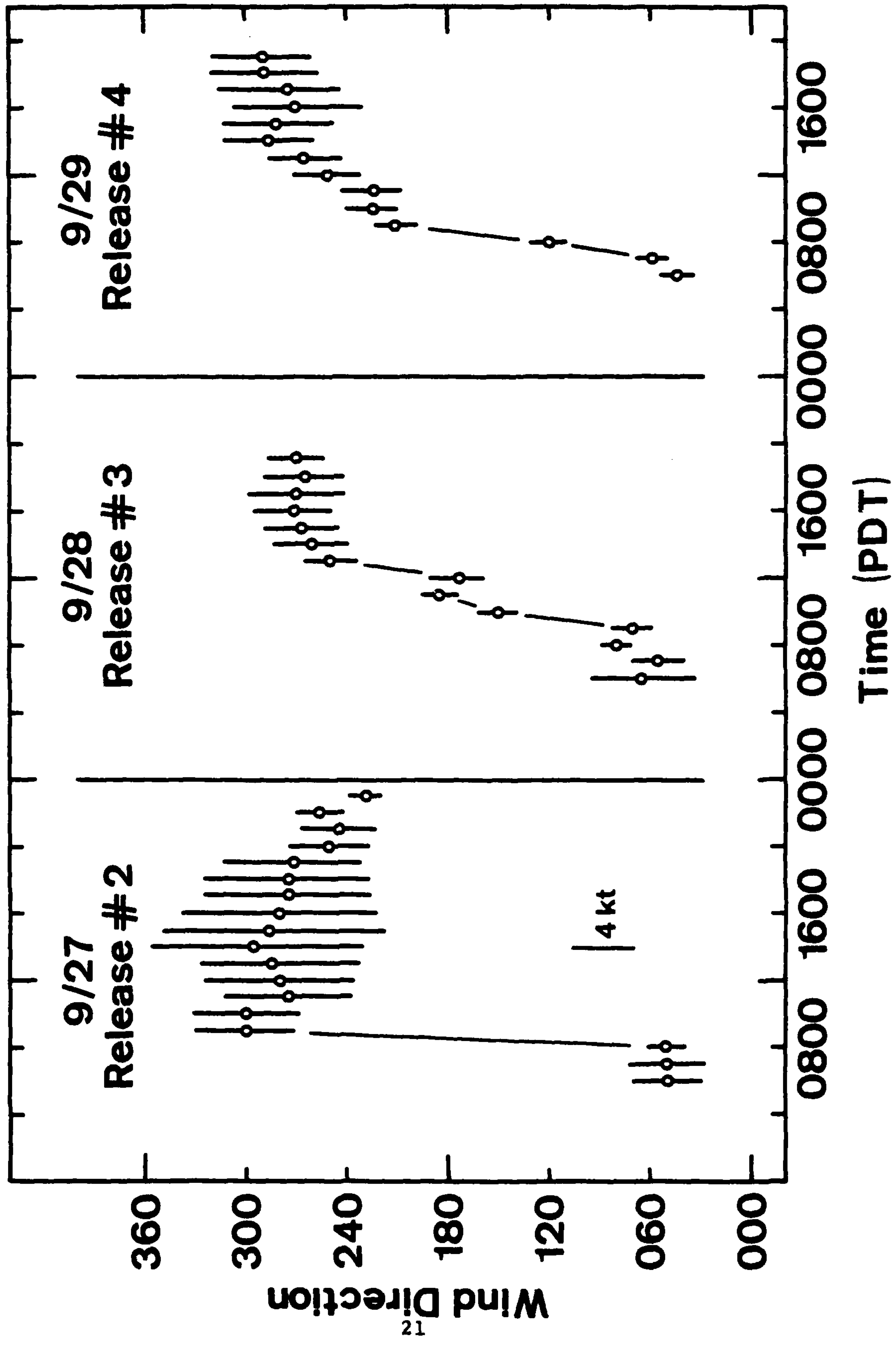
The local situation during the time of the operation was one of light and variable winds. During the late night and early morning the wind was generally easternly, switching to onshore flow in the late morning or early afternoon. If the changeover was too late, or the winds too light a tracer gas experiment could not be performed. As can be seen from the figures, the time at which the wind direction began to change, and the rapidity of the wind speed magnitude change, is a good predictor of the ultimate direction and speed.

Figure 1a



9/22
9/23
9/24
Release #1
4 kt
Time (PDT)
0800
1600
0000
Wind Direction
360
300
240
180
120
060
000

Figure 1b



9/27
Release # 2
9/28
Release # 3
9/29
Release # 4
4 kt
Wind Direction
360
300
240
180
120
060
000
0800
1600
00000
Time (PDT)

VI. Radiosonde Results

Radiosondes were released from the ship twice in each 24-hour period, generally at 0000 and 1200 PDT. Releases were made and interpreted by a Navy radiosonde team. Temperature and humidity were determined at standard levels and significant points. Since we are interested in the detailed structure of the boundary layer such a treatment is too coarse. Thus, the original strip chart output and the met team determined calibration points were used to construct fine scale graphs, which are presented in Figures 2.

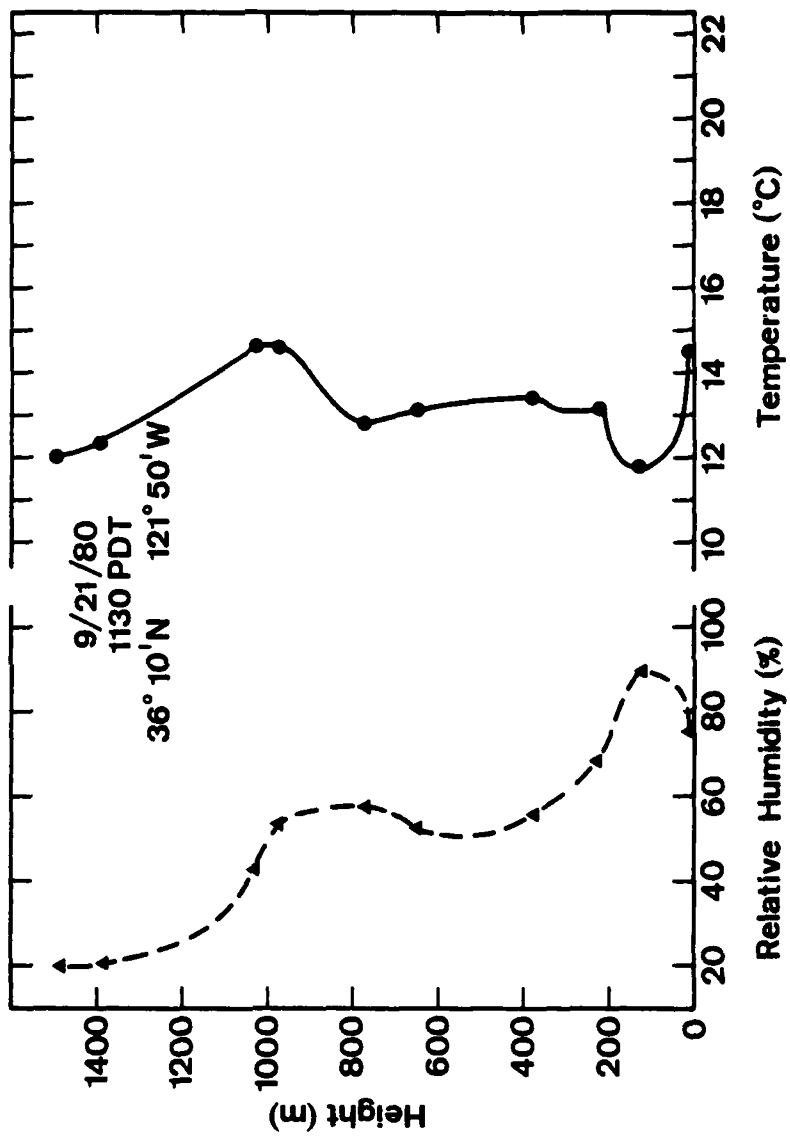

9/21/80
1130 PDT
36° 10'N 121° 50'W
Height (m)
0
200
400
600
800
1000
1200
1400
20
40
60
80
100
Relative Humidity (%)
10
12
14
16
18
20
22
Temperature (°C)

Figure 2a

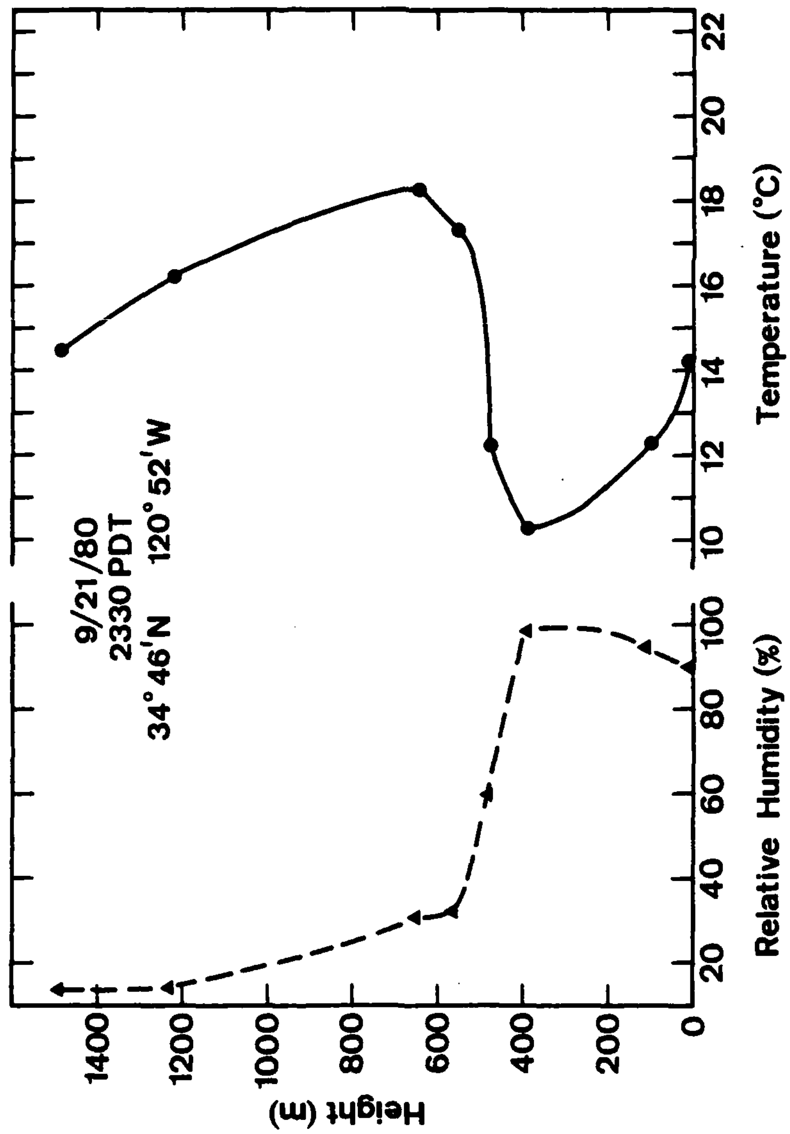

9/21/80
2330 PDT
34° 46'N 120° 52'W
Height (m)
Relative Humidity (%)
Temperature (°C)

Figure 2b

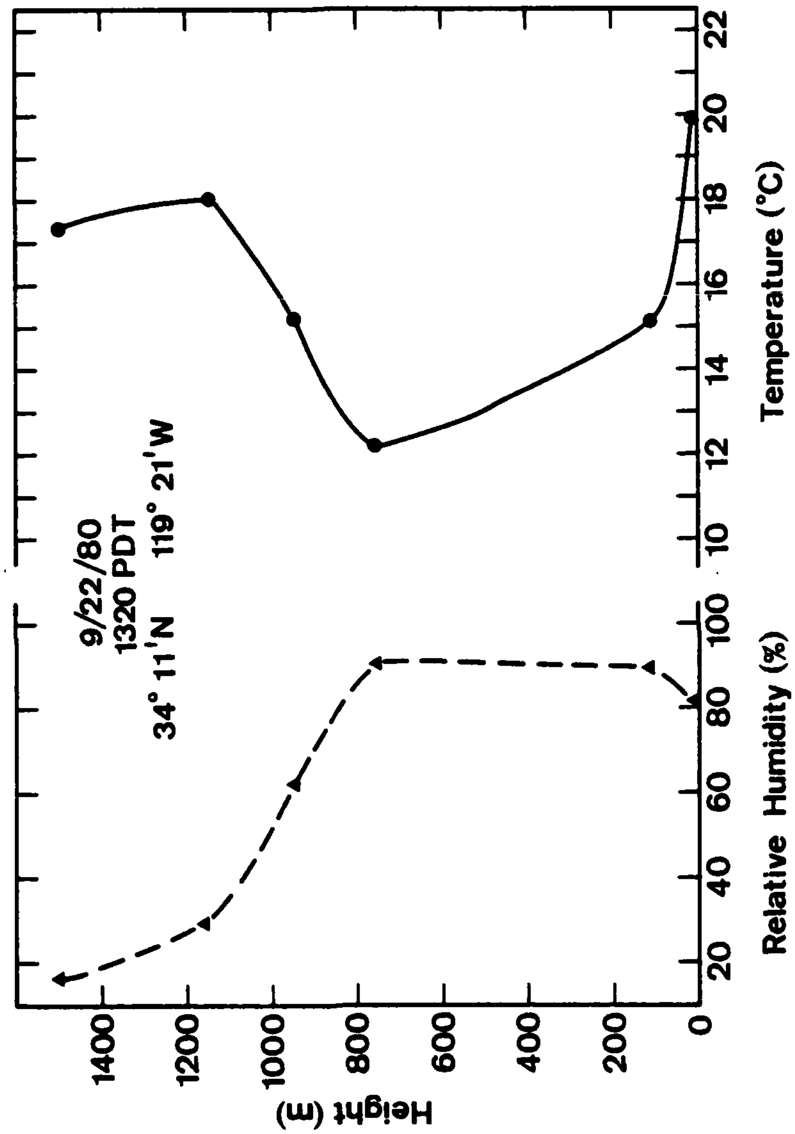

9/22/80
1320 PDT
34° 11'N 119° 21'W
Height (m)
Temperature (°C)
Relative Humidity (%)
0
200
400
600
800
1000
1200
1400
20
40
60
80
100
10
12
14
16
18
20
22

Figure 2c

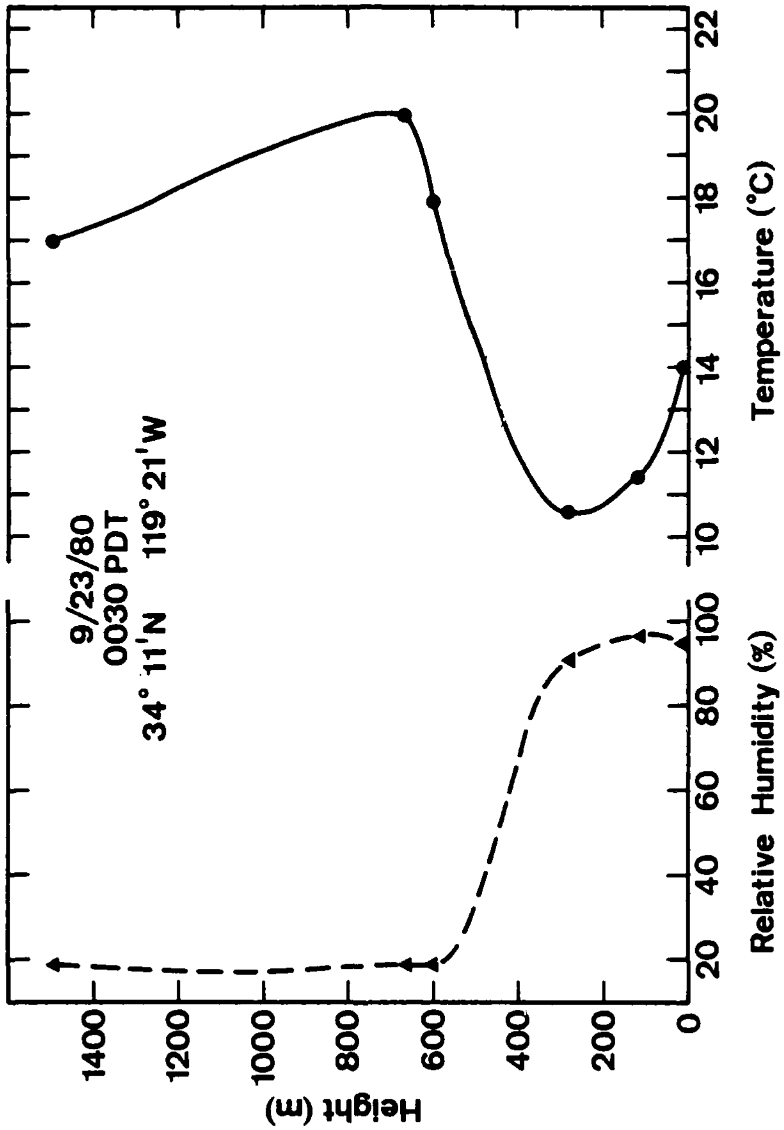

9/23/80
0030 PDT
34° 11'N 119° 21'W
Height (m)
0
200
400
600
800
1000
1200
1400
Relative Humidity (%)
20
40
60
80
100
Temperature (°C)
10
12
14
16
18
20
22

Figure 2d

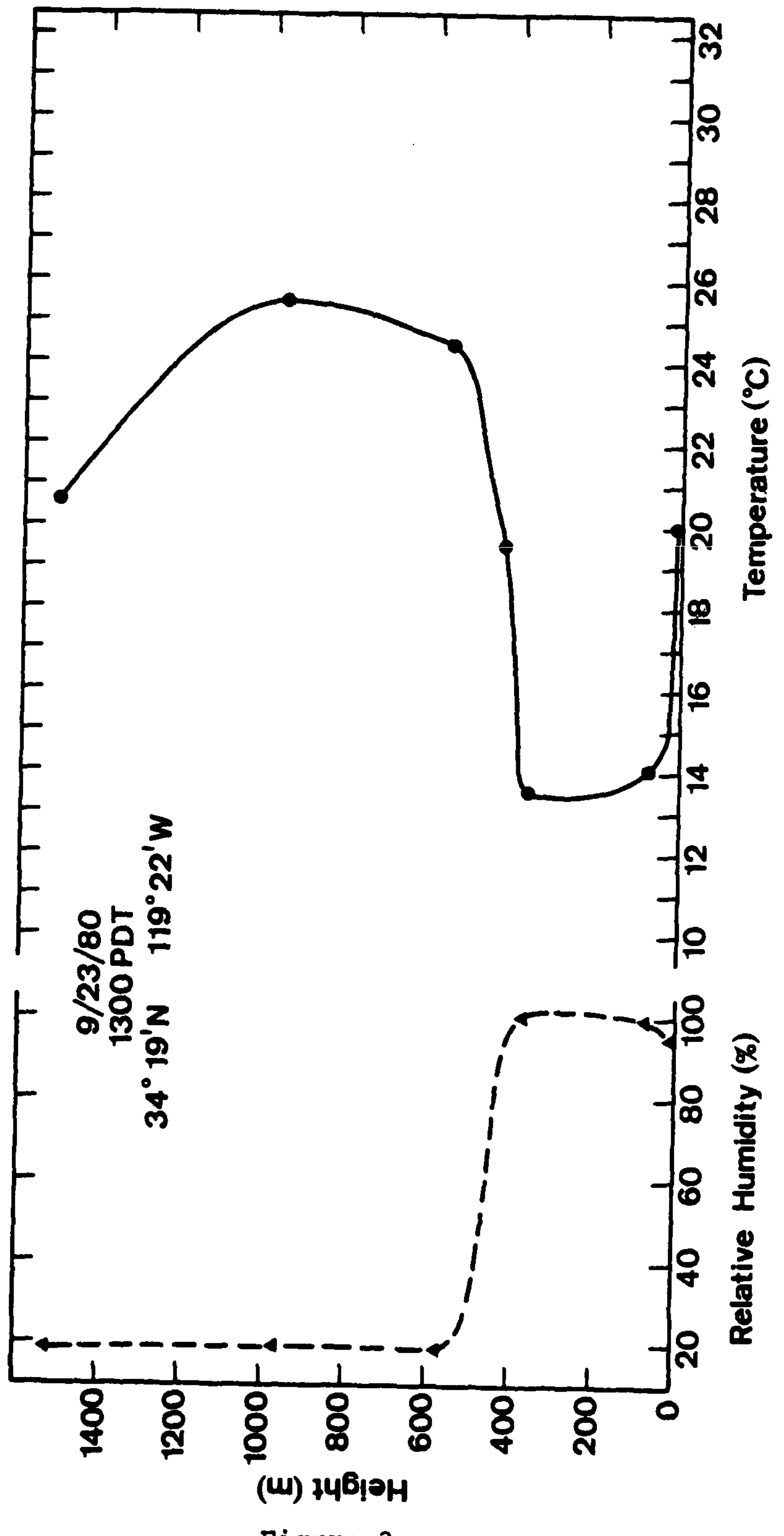

9/23/80
1300 PDT
34° 19'N 119°22'W
Temperature (°C)
10 12 14 16 18 20 22 24 26 28 30 32
Relative Humidity (%)
20 40 60 80 100
Height (m)
0 200 400 600 800 1000 1200 1400

Figure 2e

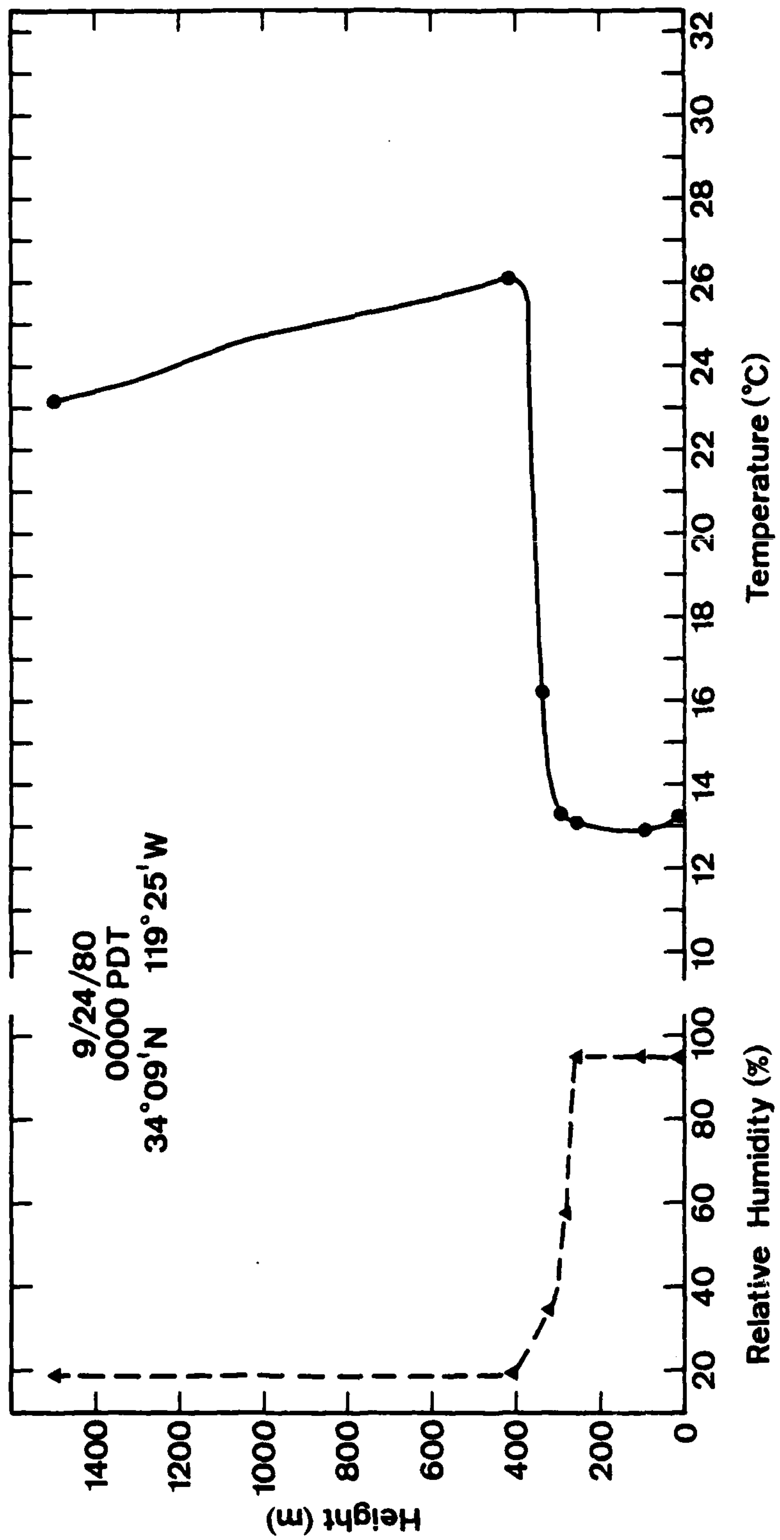

9/24/80
0000 PDT
34°09'N 119°25'W
Height (m)
Temperature (°C)
Relative Humidity (%)

Figure 2f

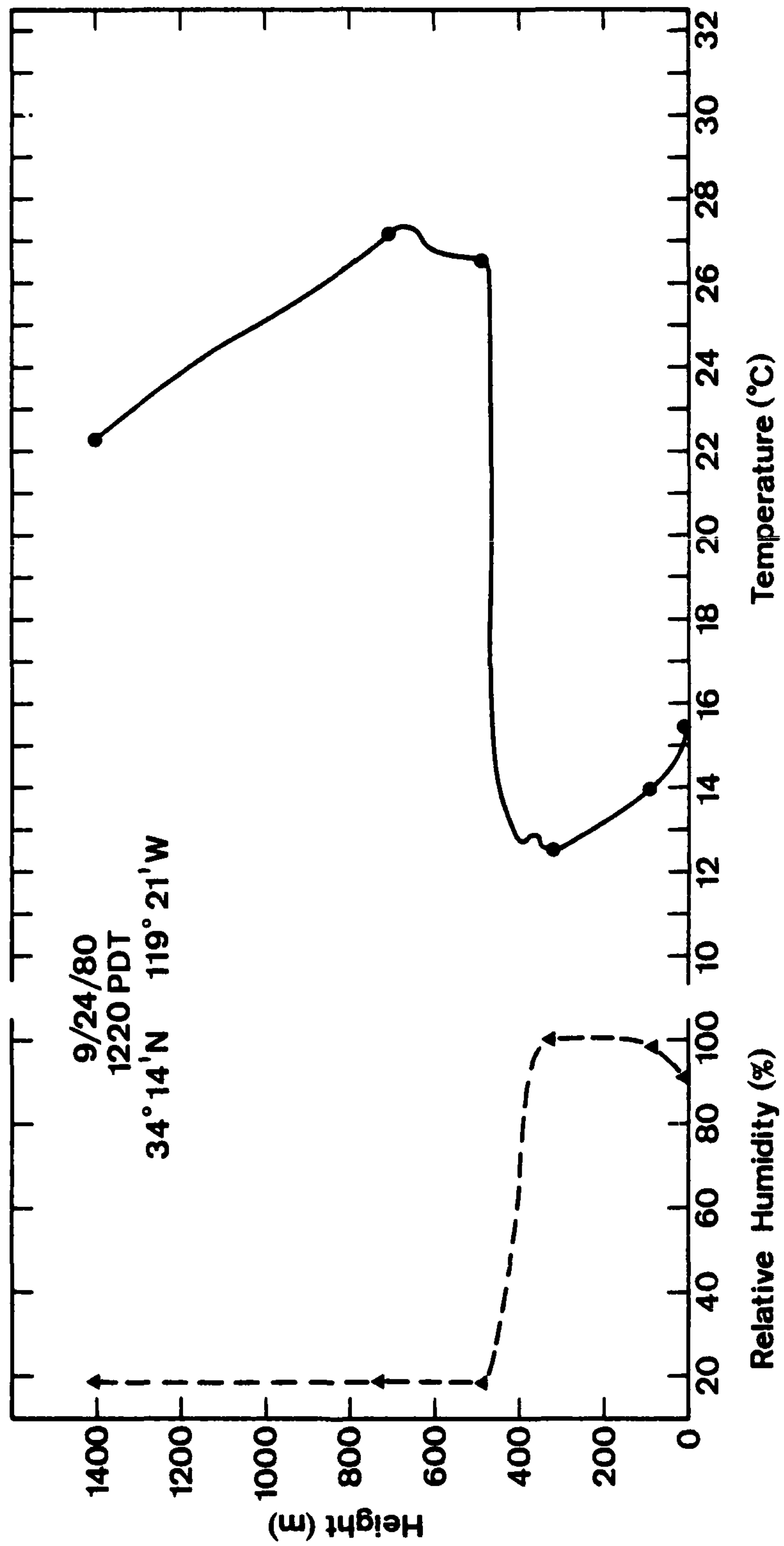

9/24/80
1220 PDT
34°14'N 119°21'W
Height (m)
Relative Humidity (%)
Temperature (°C)
0
200
400
600
800
1000
1200
1400
20
40
60
80
100
10
12
14
16
18
20
22
24
26
28
30
32

Figure 2g

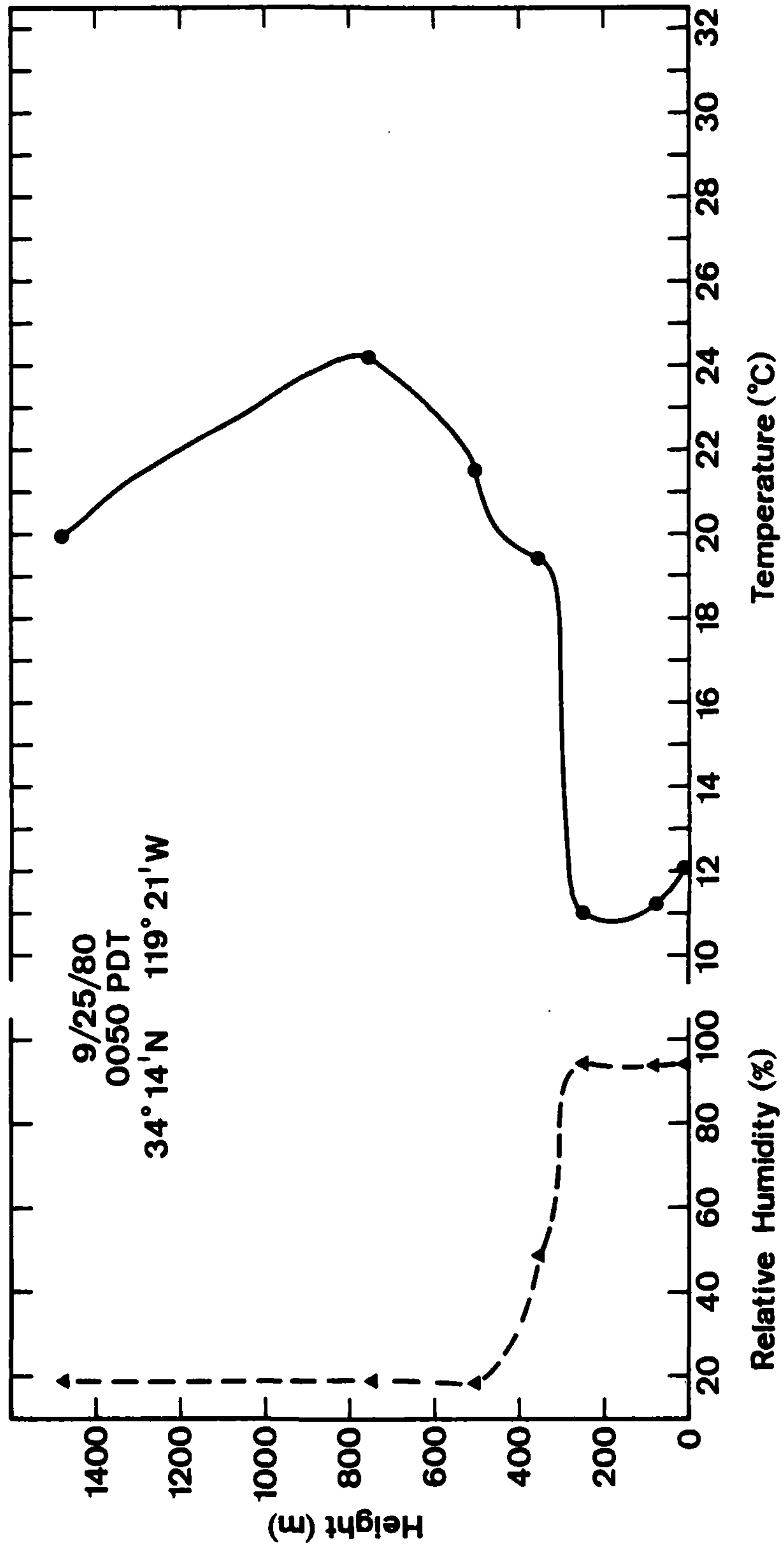

9/25/80
0050 PDT
34°14'N 119°21'W
Height (m)
Temperature (°C)
Relative Humidity (%)

Figure 2h

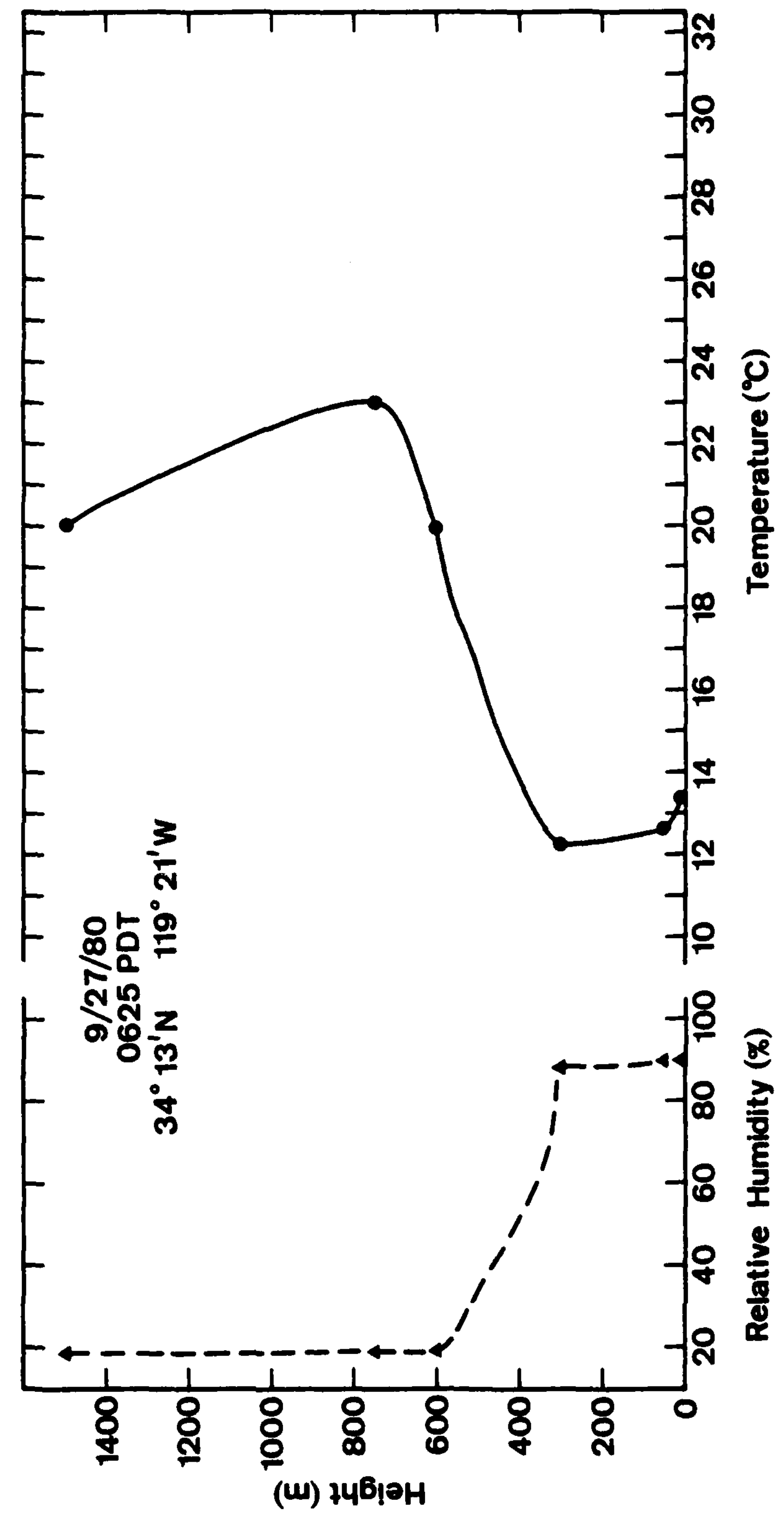

9/27/80
0625 PDT
34° 13'N 119° 21'W
Height (m)
Temperature (°C)
Relative Humidity (%)

Figure 2i

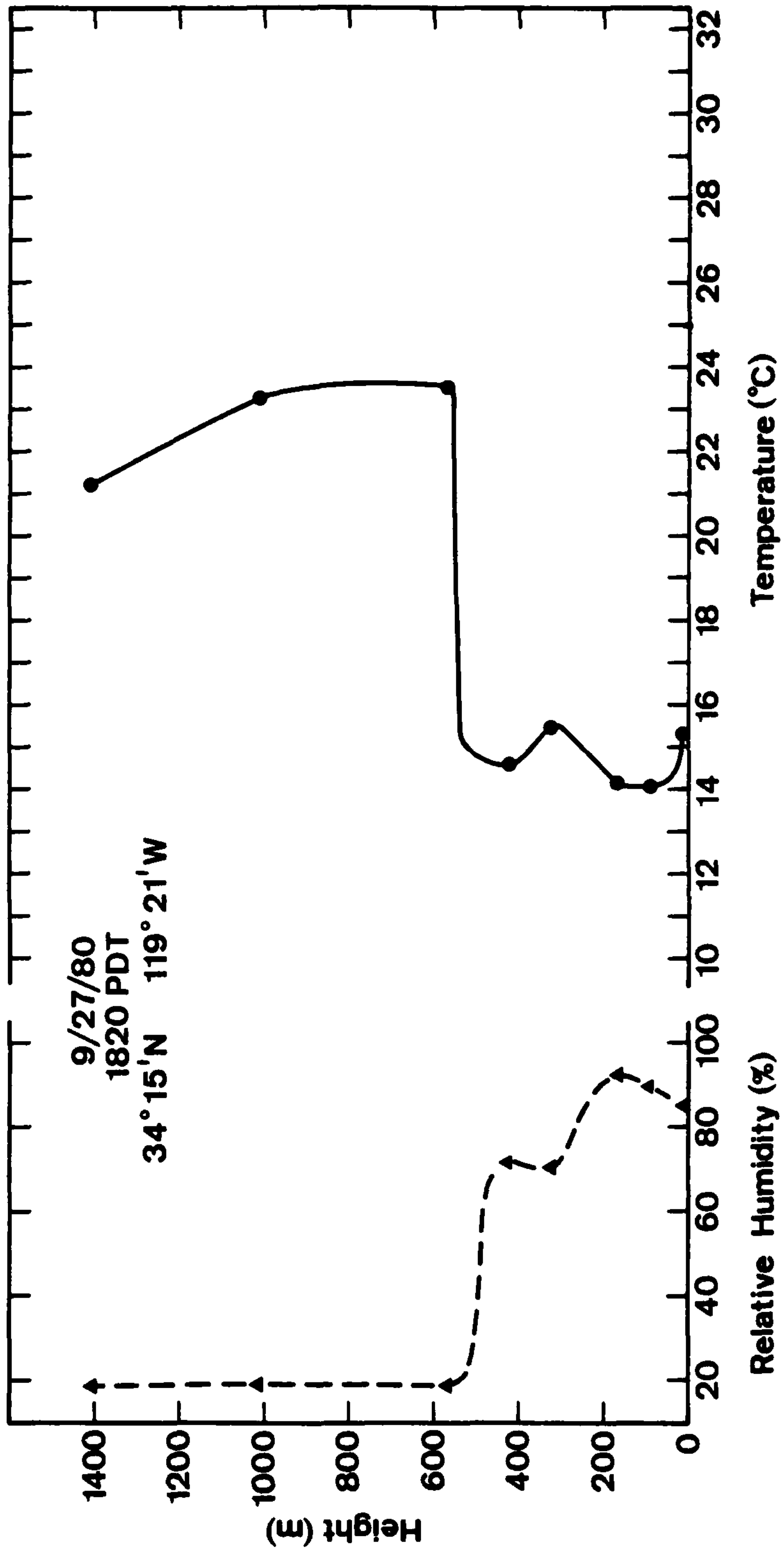

9/27/80
1820 PDT
34°15'N 119°21'W
Height (m)
0
200
400
600
800
1000
1200
1400
Relative Humidity (%)
20
40
60
80
100
Temperature (°C)
10
12
14
16
18
20
22
24
26
28
30
32

Figure 2j

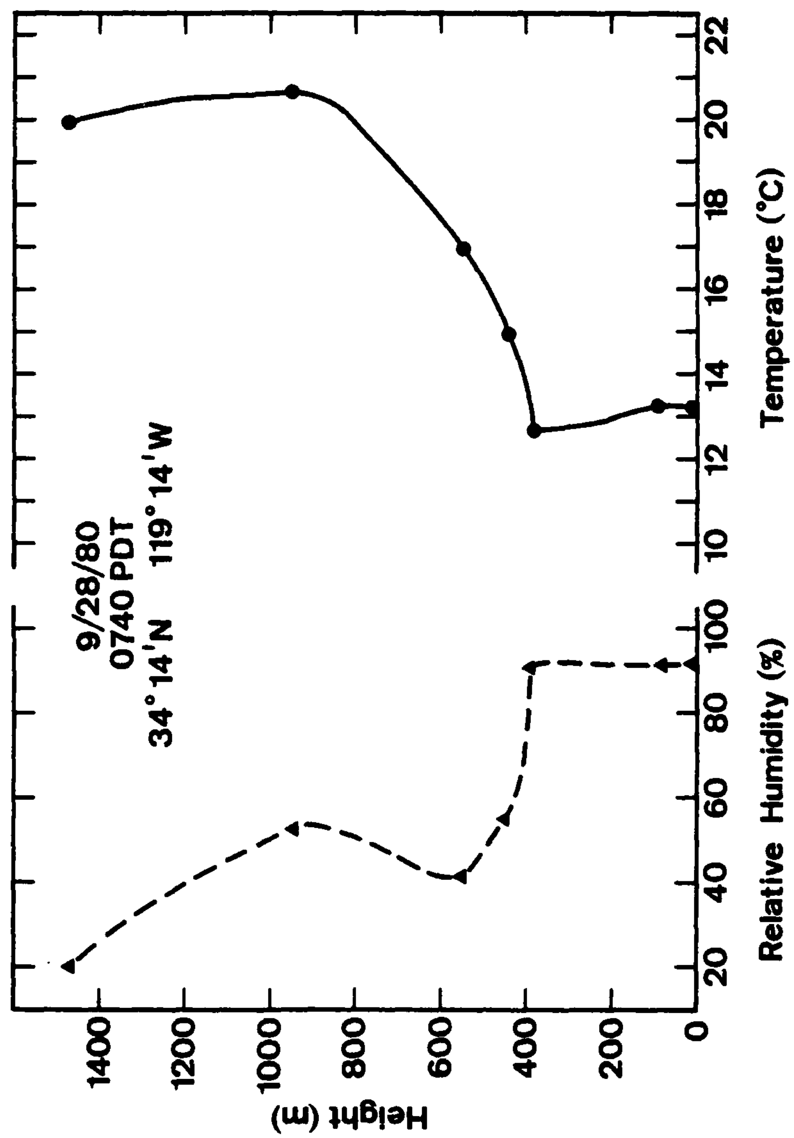

9/28/80
0740 PDT
34° 14'N 119° 14'W
Height (m)
Relative Humidity (%)
Temperature (°C)

Figure 2k

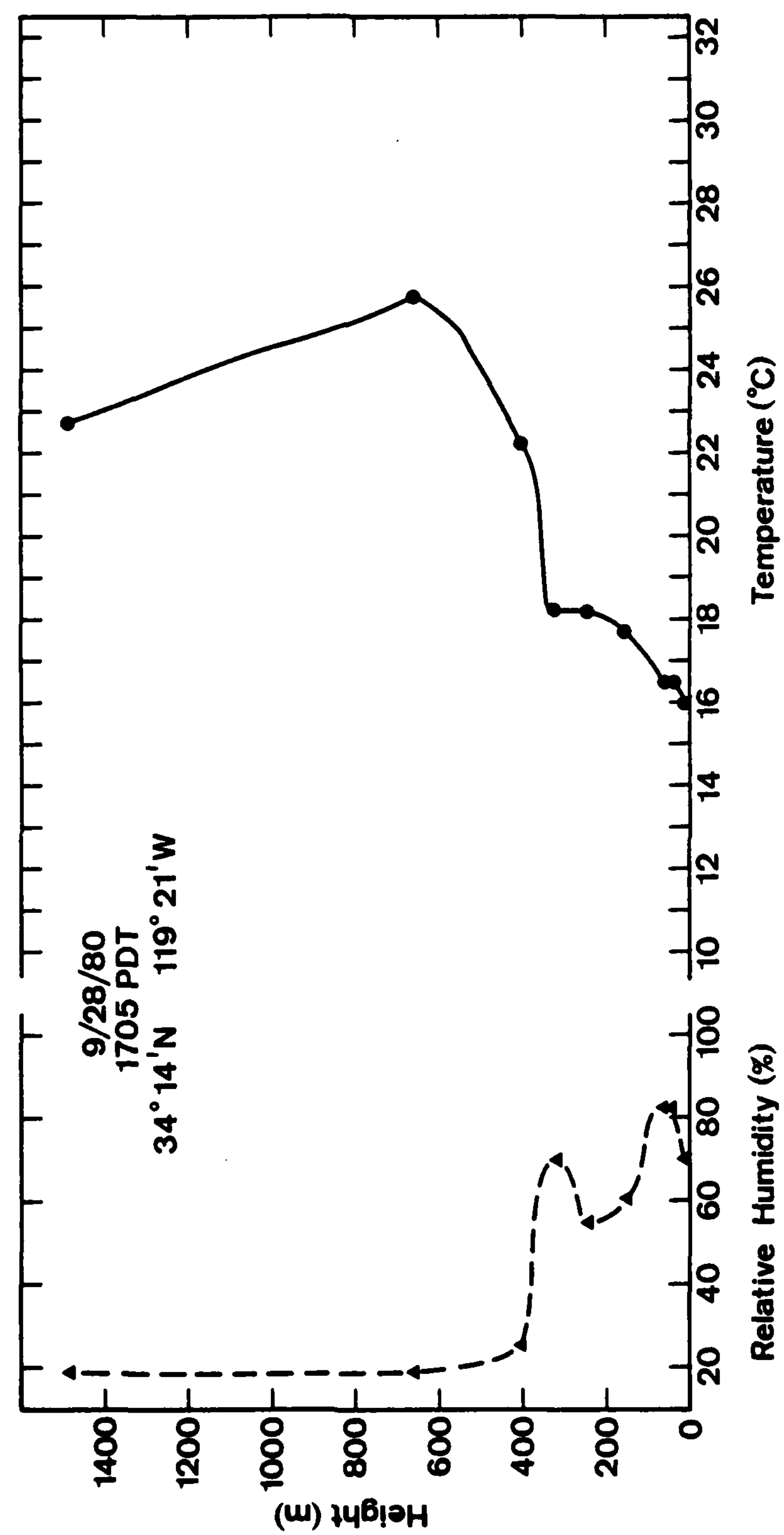

9/28/80
1705 PDT
34°14'N 119°21'W
Height (m)
Relative Humidity (%)
Temperature (°C)
0
200
400
600
800
1000
1200
1400
20
40
60
80
100
10
12
14
16
18
20
22
24
26
28
30
32

Figure 21

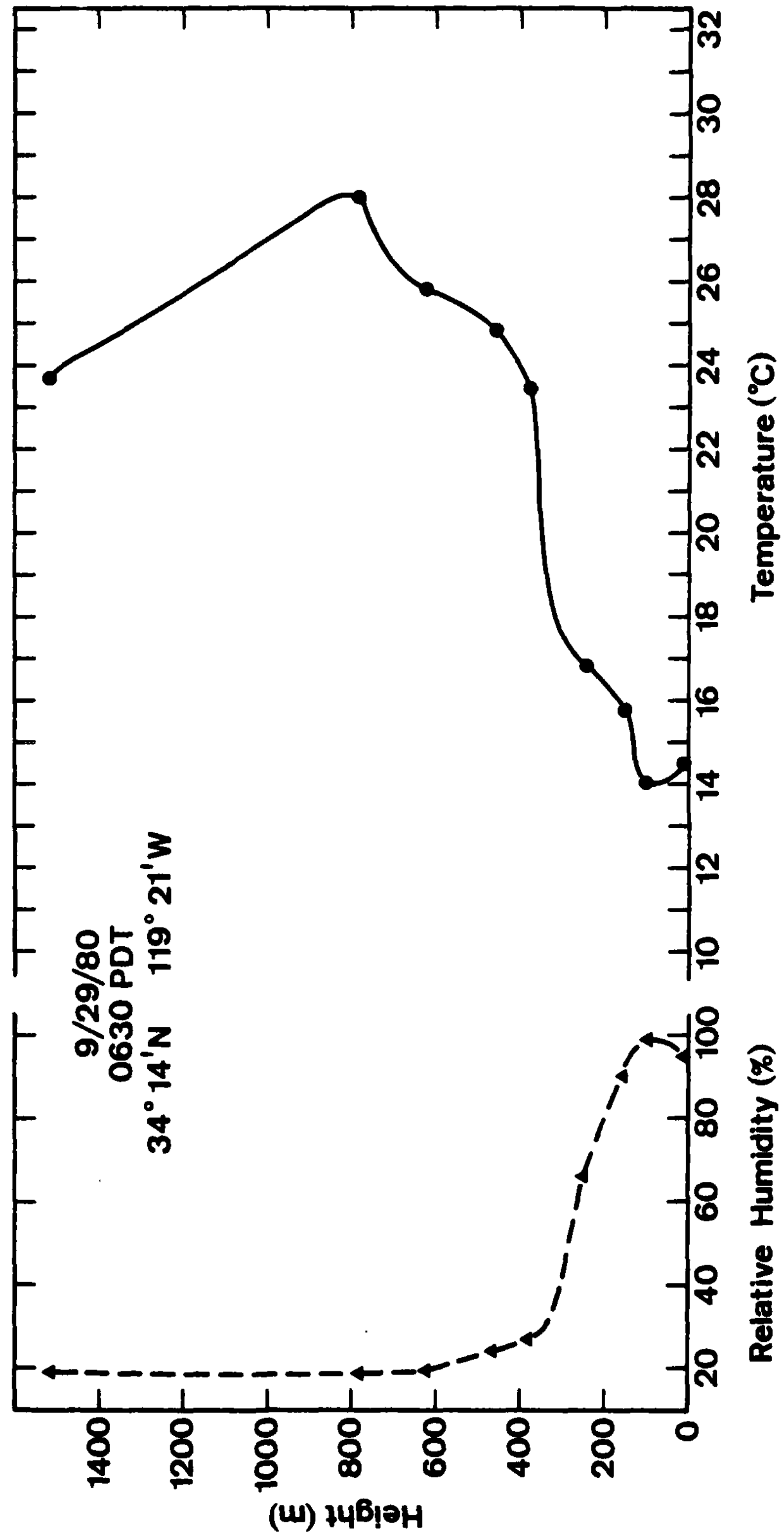

9/29/80
0630 PDT
34° 14'N 119° 21'W
Height (m)
0
200
400
600
800
1000
1200
1400
Relative Humidity (%)
20
40
60
80
100
Temperature (°C)
10
12
14
16
18
20
22
24
26
28
30
32

Figure 2m

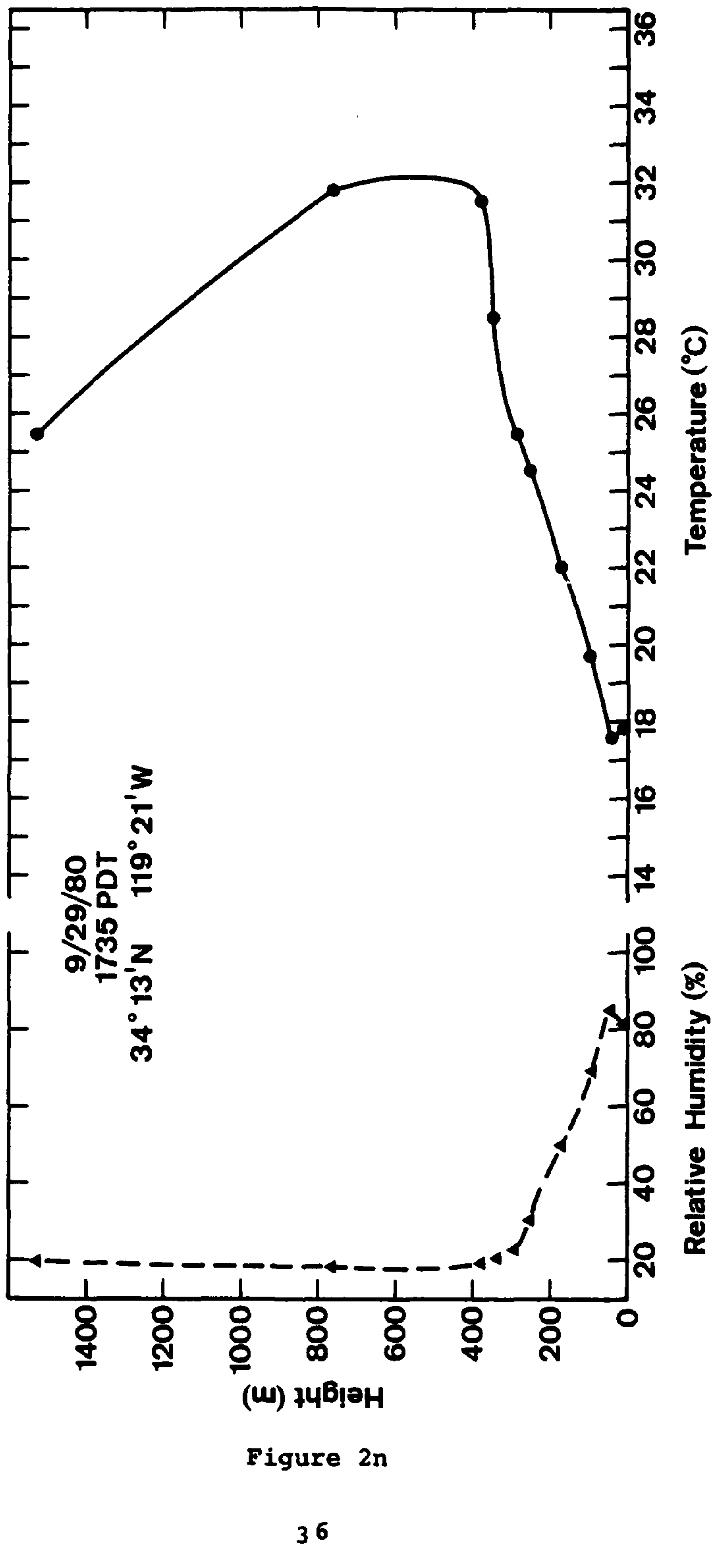

9/29/80
1735 PDT
34° 13'N 119° 21'W
Height (m)
0
200
400
600
800
1000
1200
1400
20
40
60
80
100
Relative Humidity (%)
14
16
18
20
22
24
26
28
30
32
34
36
Temperature (°C)

Figure 2n

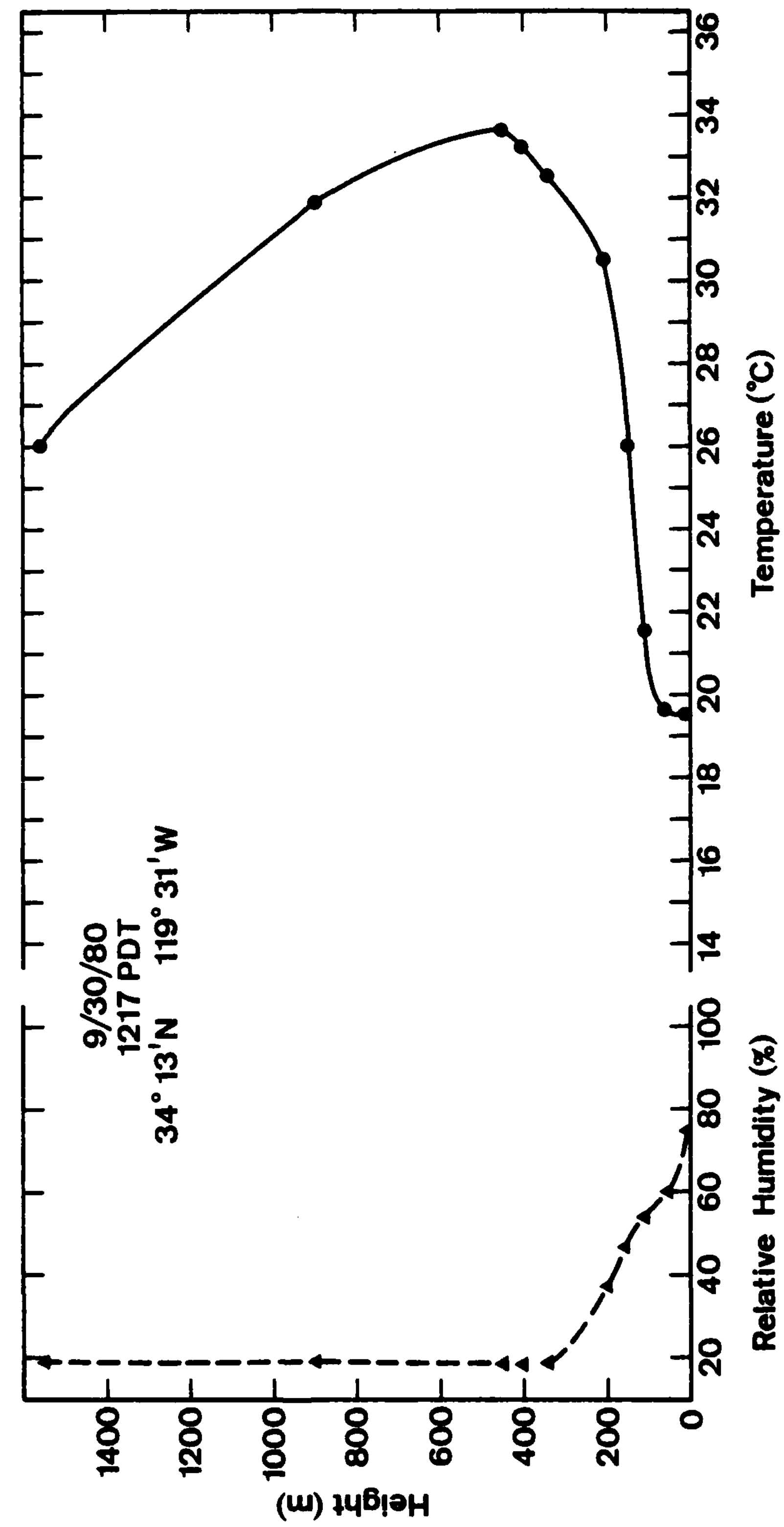

9/30/80
1217 PDT
34° 13'N 119° 31'W
Height (m)
0
200
400
600
800
1000
1200
1400
Relative Humidity (%)
20
40
60
80
100
Temperature (°C)
14
16
18
20
22
24
26
28
30
32
34
36

Figure 2o

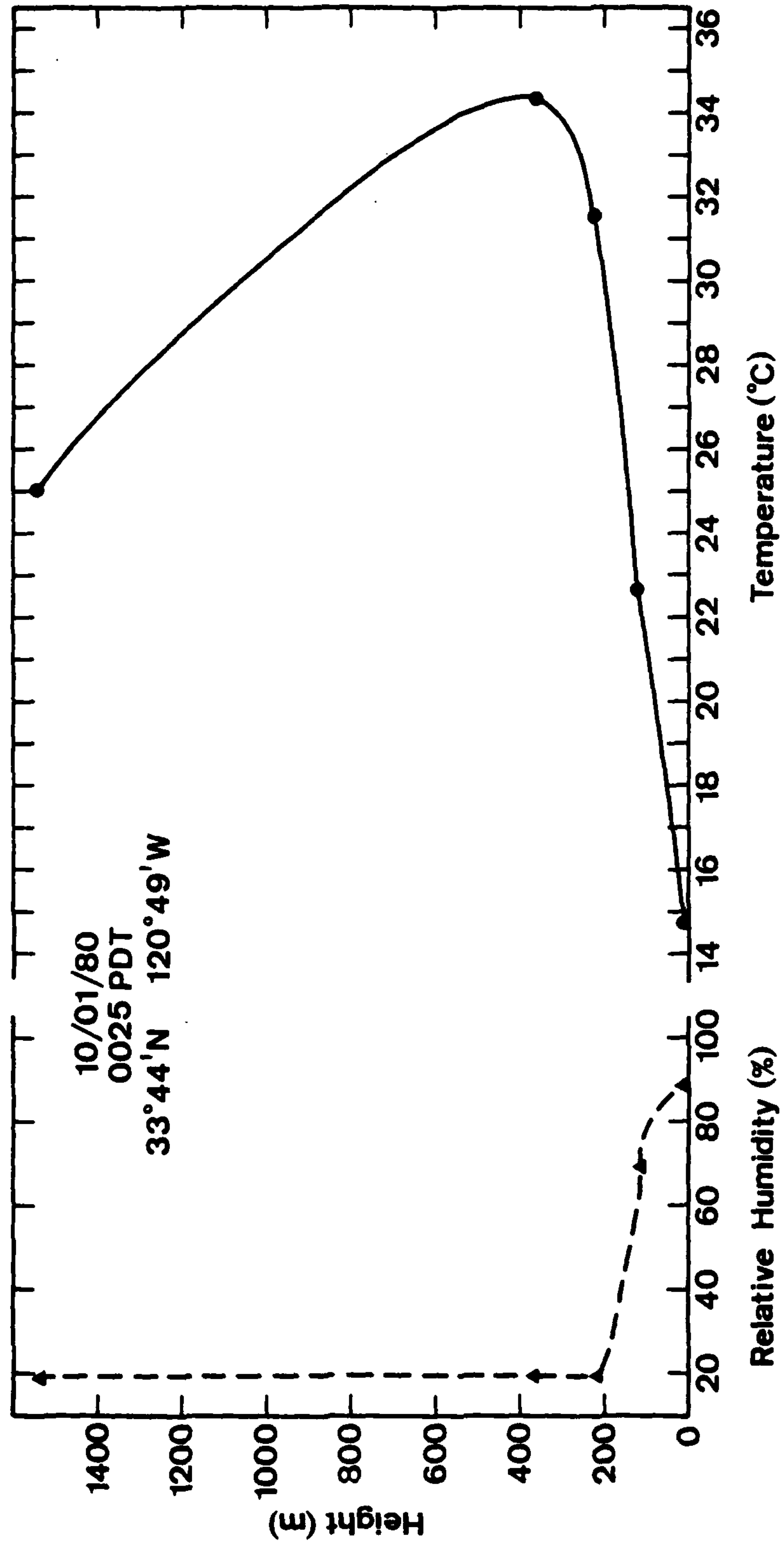

10/01/80
0025 PDT
33°44'N 120°49'W
Height (m)
Temperature (°C)
Relative Humidity (%)

Figure 2p

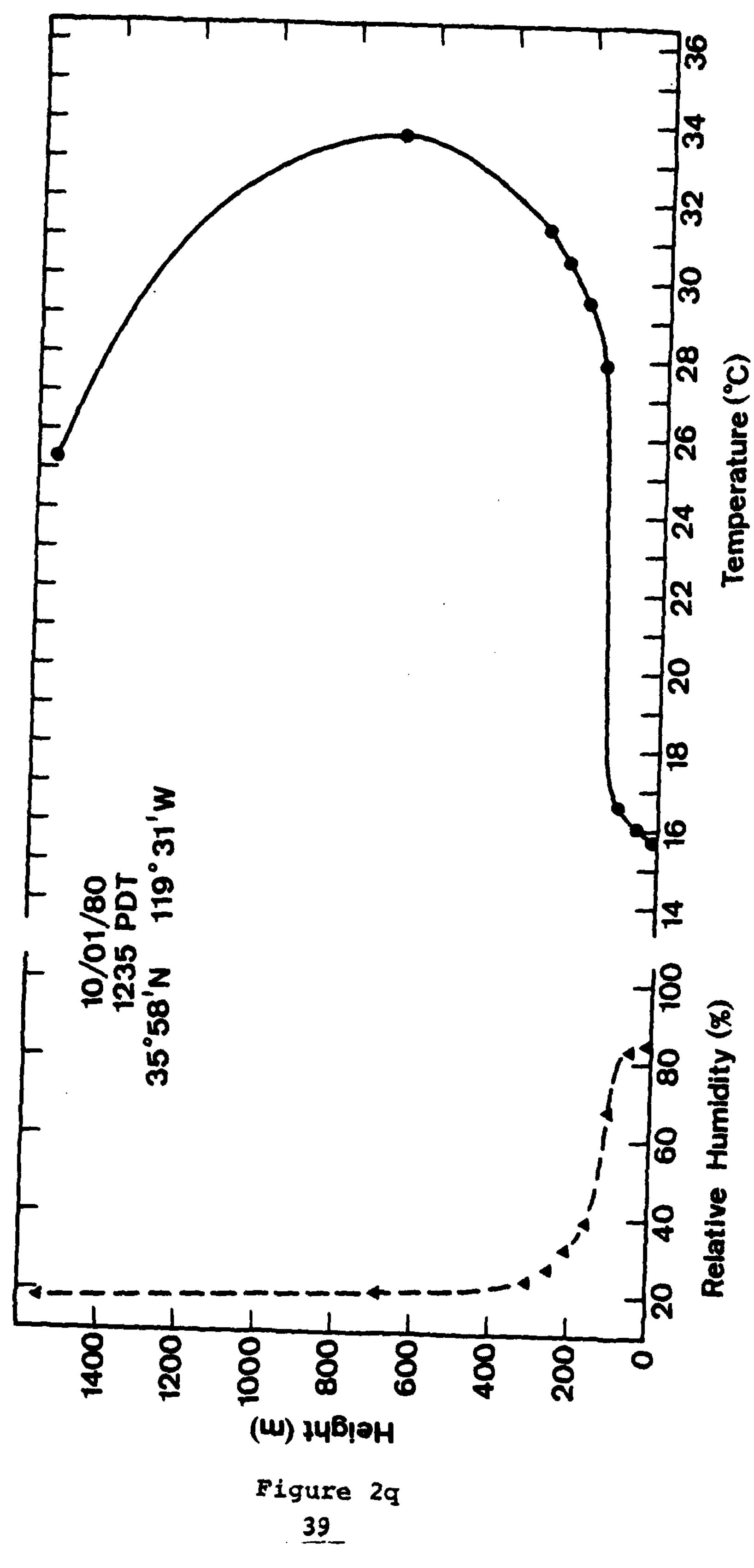

10/01/80
1235 PDT
35°58'N 119°31'W
Temperature (°C)
Relative Humidity (%)
Height (m)
14
16
18
20
22
24
26
28
30
32
34
36
20
40
60
80
100
0
200
400
600
800
1000
1200
1400

Figure 2q

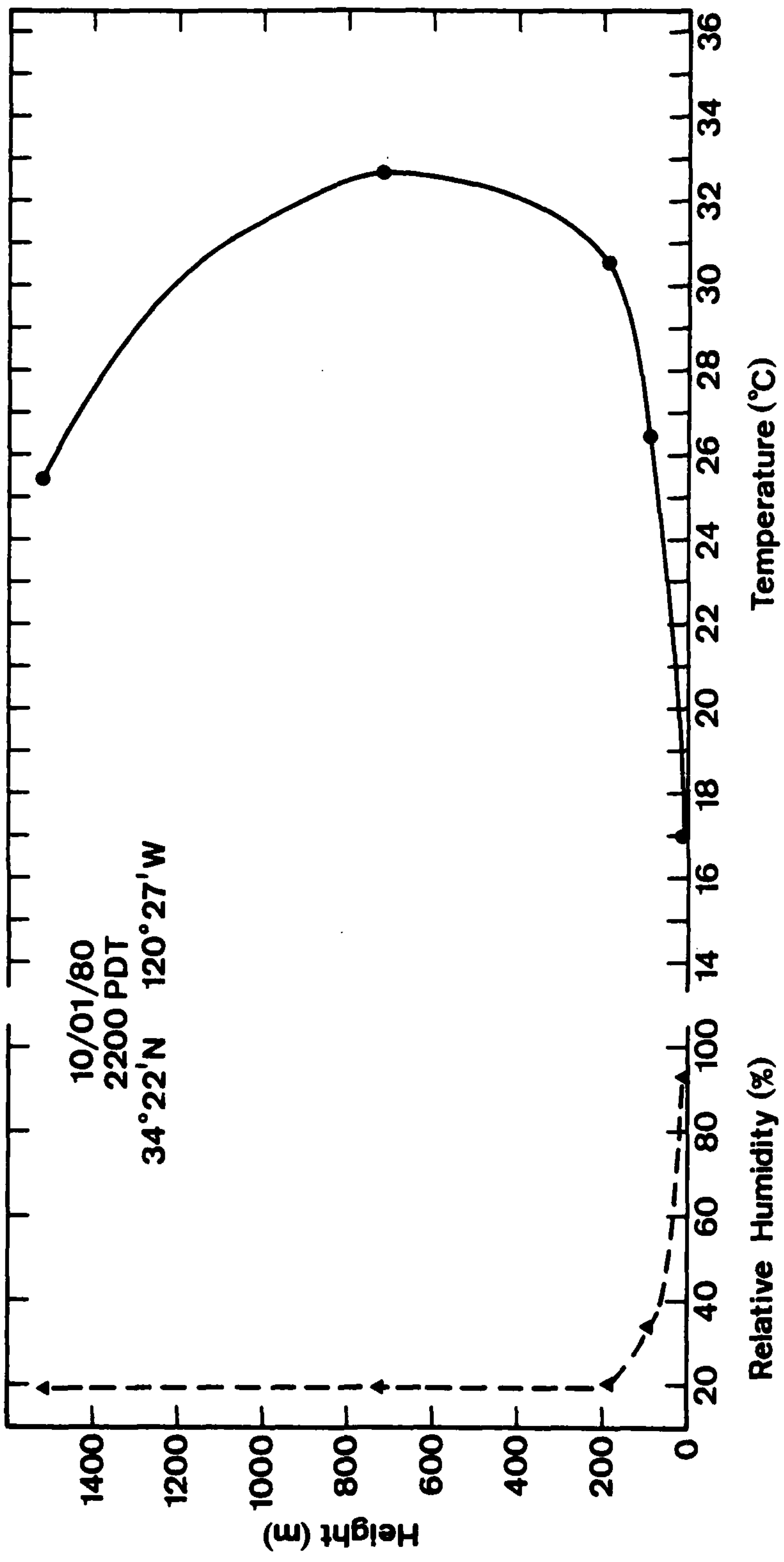

10/01/80
2200 PDT
34°22'N 120°27'W
Height (m)
0
200
400
600
800
1000
1200
1400
Relative Humidity (%)
20
40
60
80
100
Temperature (°C)
14
16
18
20
22
24
26
28
30
32
34
36

Figure 2r

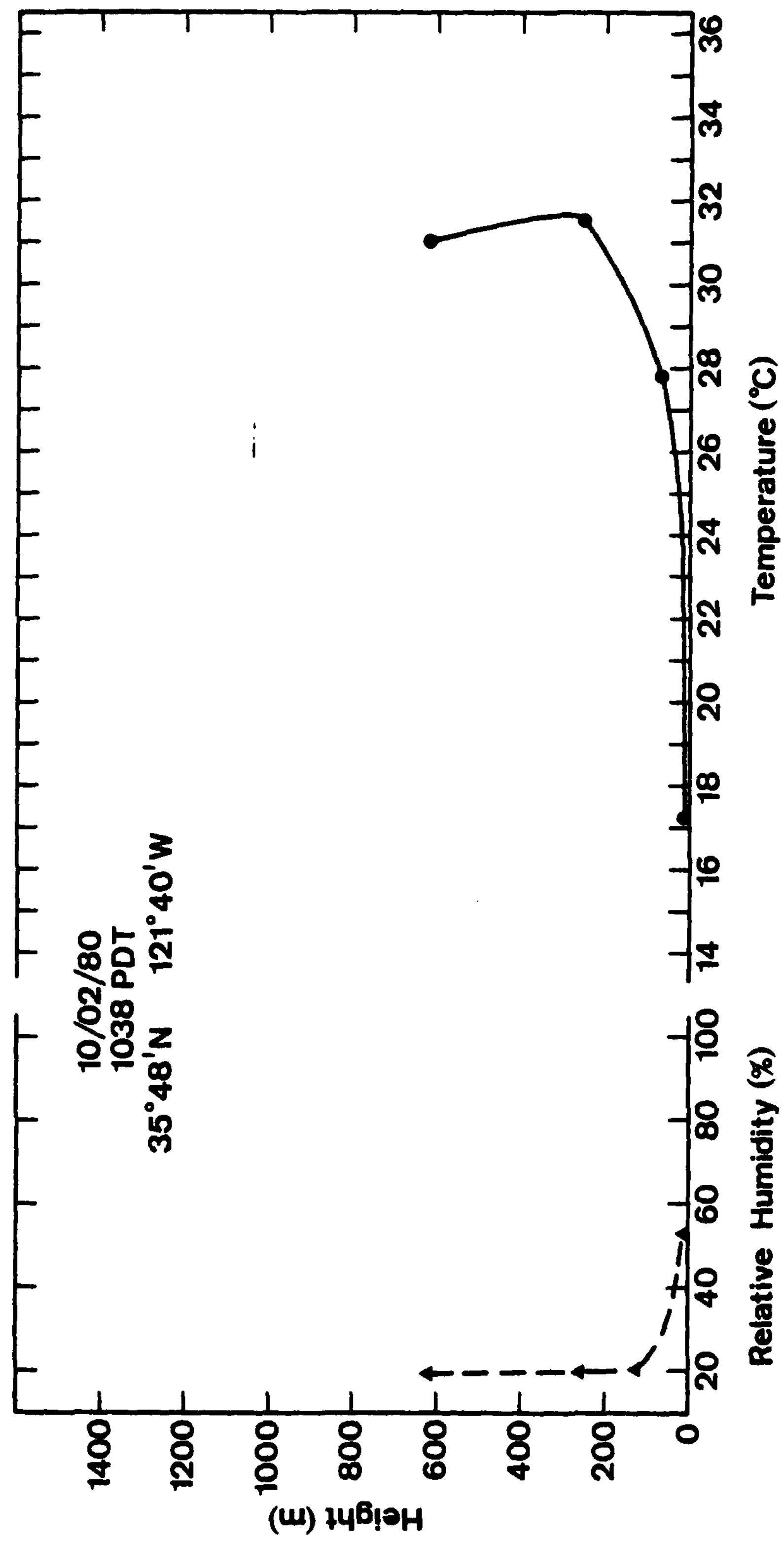

10/02/80
1038 PDT
35°48'N 121°40'W
Height (m)
0
200
400
600
800
1000
1200
1400
Relative Humidity (%)
20
40
60
80
100
Temperature (°C)
14
16
18
20
22
24
26
28
30
32
34
36

Figure 2s

VII. Acoustic Sounder Inversion Height

The acoustic sounder was operating on a nearly continual basis throughout the cruise. In Table 5 we list the inversion height as determined from the sounder strip chart output. At times it is difficult to determine the correct height because of multiple layering so more than one height is given. Photographs of the strip charts are shown in Figures 3 as they can greatly aid in determining the boundary layer depth, especially when they are compared with the radiosonde results.

Normally, it is fairly easy to determine the boundary layer depth from acoustical sounder records, especially over the ocean. This was not true for this operation. The ship was near land and the period was during a major smog event. Multiple layering was common and even with radiosonde results it was not always possible to determine the height of the well-mixed layer.

Figure 3a

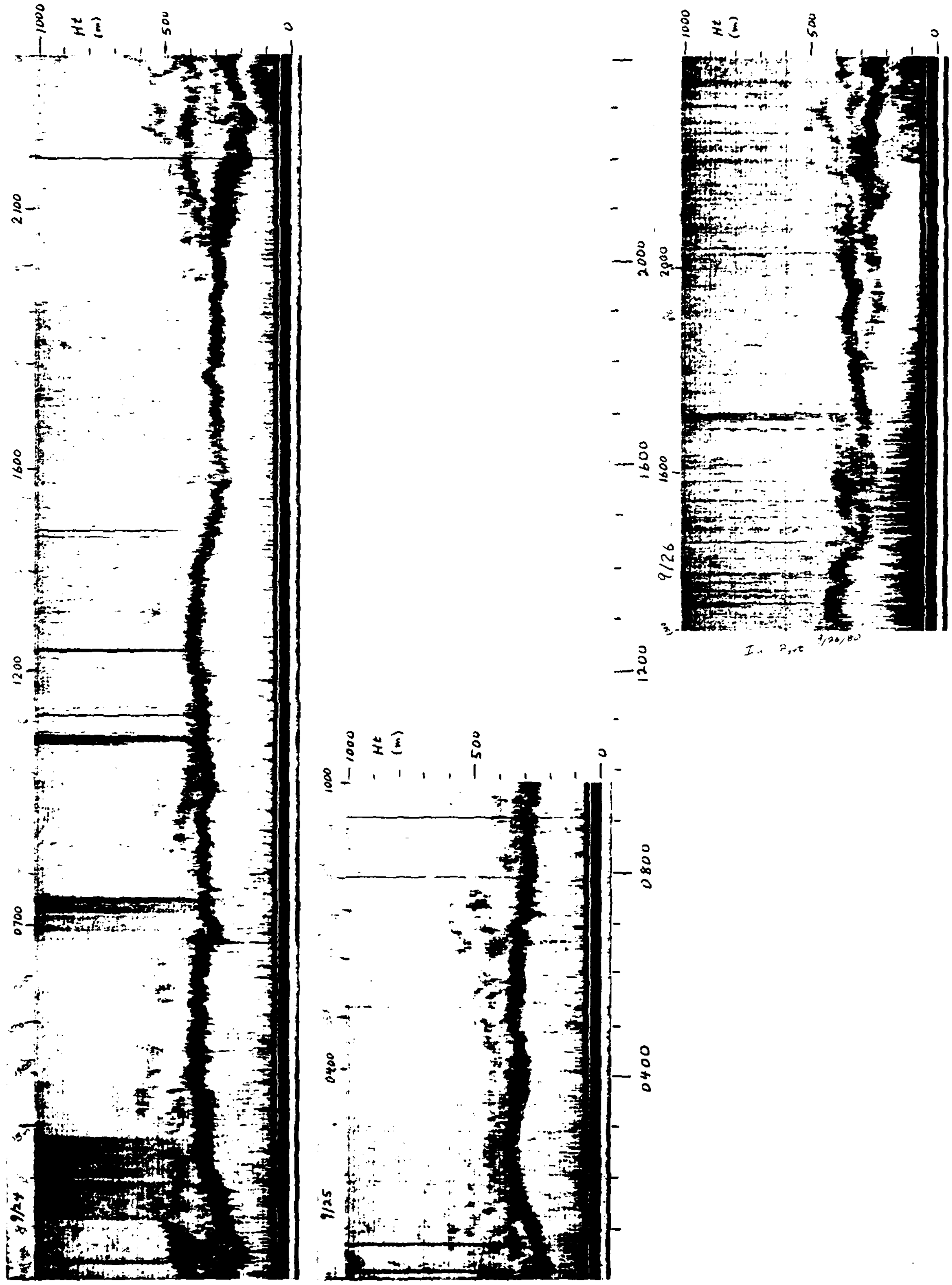
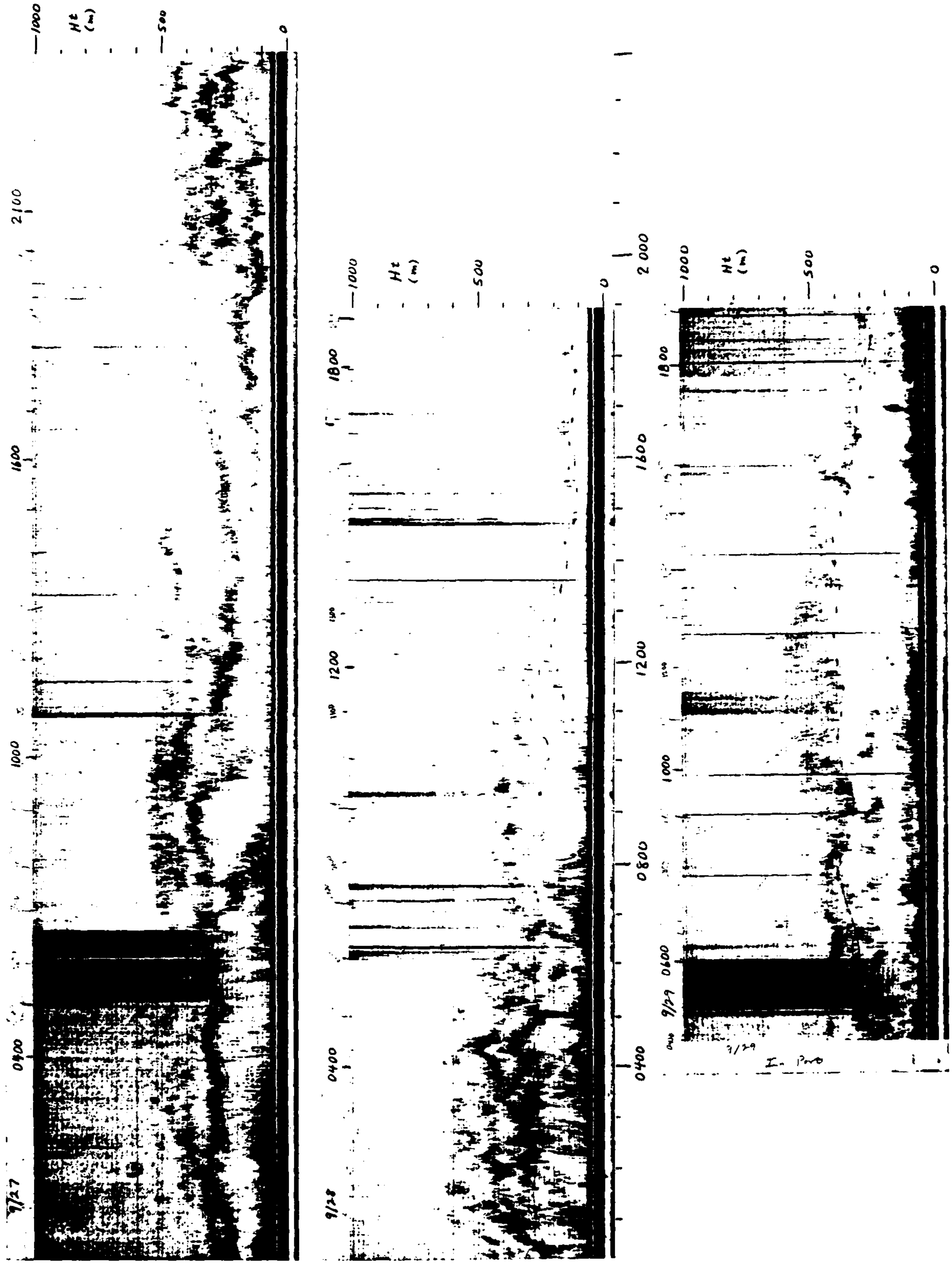


Figure 3b



1000
Ht (m)
500
0
2100
1800
1600
1200
1000
0800
0600
0400
2000
9/27
9/28
9/29

Figure 3c

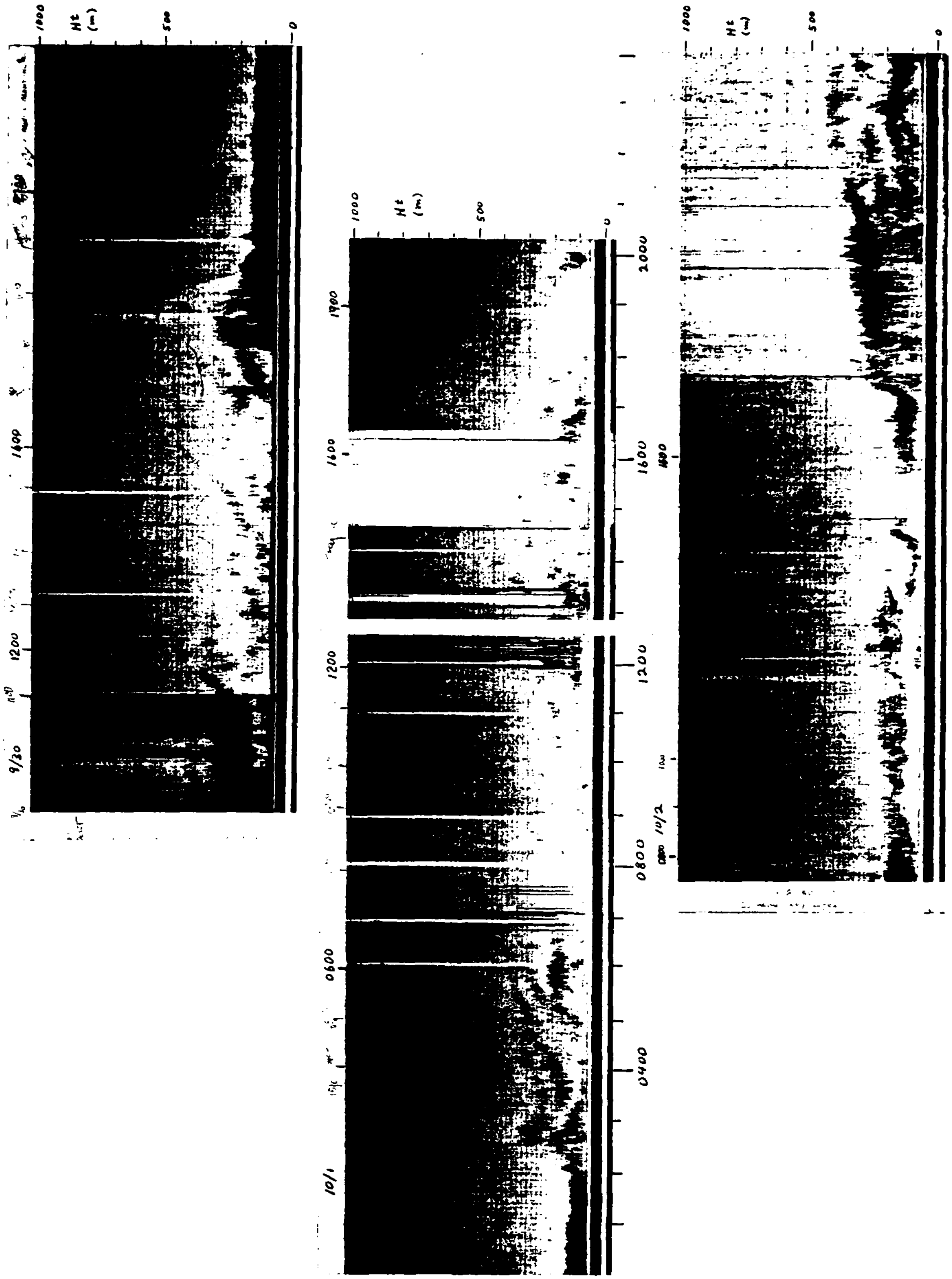


Figure 3d

Table 5. Inversion height as determined from the acoustic sounder. More than one height is listed when multiple layering makes the situation ambiguous.

DATE	TIME	Z(m)	
09/21	0900	0	
	1130	0	
	1200	90	
	1230	120	
	1300	100	
	1330	70	
	1500	60	
	1530	70	
	1600	70	
	1630	0	
	1730	0	160
	1800	0	210
	1830	80	260
	1900	120	
	1930	180	
	2000	240	
	2030	300	
	2100	340	
	2130	290	
	2200	190	
	2230	0	
	2300	300	
	2330	340	
	2400	380	
9/22	0030	400	
	0100	430	
	0130	460	
	0145	350	
	0200	220	
	0230	190	
	0300	160	
	0330	140	
	0400	80	
	0600	0	
	0630	280	
	0700	320	
	0730	410	
	0800	460	
	0830	500	
	0900	520	
	0930	550	
	1000	560	
	1030	570	
	1100	580	
	1130	140	580
	1200	230	590
	1400		
	1430	220	520
	1500	220	450
	1530	240	410
	1600	210	
	1630	270	
9/22	1700	260	
	1730	310	
	1800	320	
	1830	340	
	1900	280	
	2000	360	
	2030	370	
	2100	360	
	2130	400	
	2200	370	
	2230	380	
	2300	300	
	2330	330	
	2400	320	
9/23	0030	340	
	0100	340	
	0130	330	
	0200	320	
	0230	310	
	0300	320	
	0330	330	
	0400	320	
	0430	310	
	0500	320	
	0530	330	
	0600	310	
	0630	320	
	0700	300	
	0730	320	
	0800	310	
	0830	340	
	0900	330	
	0930	340	
	1000	320	
	1030	310	
	1100	330	
	1130	340	
	1200	350	
	1230	360	
	1300	370	
	1330	350	
	1400	330	
	1430	310	
	1500	320	
	1530	330	
	1600	310	
	1630	300	
	1700	290	
	1730	280	
	1800	260	
	1830	270	
	1900	290	

DATE	TIME	Z(m)	
9/23	1930	300	
	2000	290	
	2030	310	
	2100	300	
	2130	240	
	2200	210	
	2230	200	
	2300	180	
	2330	200	
9/24	0000	210	
	0030	190	390
	0100	230	
	0130	250	
	0200	270	
	0230	300	
	0300	310	
	0330	320	
	0400	340	
	0430	320	
	0500	330	
	0530	340	
	0600	320	
	0630	310	
	0700	290	
	0730	310	
	0800	320	
	0830	310	
	0900	320	
	0930	310	
	1000	300	
	1030	330	
	1100	320	
	1130	330	
	1200	350	
	1230	360	
	1300	340	
	1330	350	
	1400	340	
	1430	310	
	1500	280	
	1530	270	
	1600	250	
	1630	270	
	1700	280	
	1730	270	
	1800	280	
	1830	270	
	1900	280	
	1930	270	
	2000	260	
	2030	240	
	2100	220	

DATE	TIME	Z(m)	
9/24	2130	210	
	2200	170	
	2230	160	
	2300	180	
	2330	200	
9/25	0000	220	
	0030	210	
	0100	230	
	0130	290	
	0200	310	
	0230	330	
	0300	320	
	0330	300	
	0400	290	
	0430	300	
	0500	320	
	0530	310	
	0600	300	
	0630	290	
	0700	240	
	0730	270	
	0800	250	
	0830	270	
	0900	260	
	0930	250	
	1000	240	
9/26	1300	350	
	1330	350	380
	1400	360	
	1430	310	
	1500	280	
	1530	300	
	1600	240	340
	1630	270	
	1700	280	
	1730	290	
	1800	300	
	1830	320	
	1900	330	
	1930	310	
	2000	240	330
	2030	250	
	2100	220	
	2130	240	
	2200	220	
	2230	210	

DATE	TIME	Z(m)	
9/27	0000	200	
	0100	210	
	0130	220	
	0200	250	
	0230	240	
	0300	260	
	0330	250	
	0400	260	
	0430	270	
	0500	250	
	0530	270	
	0600	270	
	0630	290	
	0700	200	
	0730	180	280
	0800	300	400
	0830	330	440
	0900	340	450
	0930	280	400
	1000	160	380
	1030	180	380
	1100	240	
	1130	230	
	1200	210	
	1230	240	
	1300	230	
	1330	210	
	1400	200	
	1430	210	
	1500	140	230
	1530	130	240
	1600	110	250
	1630	120	270
	1700	110	290
	1730	130	340
	1800	140	360
	1830	150	
	1900	160	
	1930	120	
	2000	100	
	2030	110	220
	2100	90	230
	2130	220	250
	2200	240	260
	2230	230	270
	2300	250	290
	2330	200	280
9/28	0000	200	
	0030	280	
	0100		
	0130		
	0200	280	

DATE	TIME	Z(m)	
9/28	0200	280	
	0230	250	
	0300	260	
	0330	270	
	0400	260	
	0430	270	
	0500	250	
	0530		
	0600		
	0630	200	
	0700		
	0730		
	0800		
	0830		
	0900		
	0930	250	
	1000	230	
	1030	240	
	1100	300	
	1130	290	
	1200	260	
	1230	210	
	1300	200	
	1330	170	
	1400	150	
	1430	160	
	1500	120	
	1530	110	
	1600	120	
	1630	140	
	1700	130	
	1730	120	
	1800	110	
	1830	130	
	1900		
9/29	0430	240	
	0500	200	280
	0530	240	
	0600	310	
	0630	320	
	0700	350	
	0730	380	
	0800	390	
	0830	360	

DATE	TIME	Z(m)	
9/29	0900	340	
	0930	360	
	1000	380	
	1030	80	400
	1100	380	
	1130	80	370
	1200	400	
	1230	410	
	1300	100	400
	1330	80	390
	1400	410	
	1430	420	
	1500	380	
	1530	340	
	1600	330	
	1630	310	
	1700	320	
	1730	300	
	1800	280	
	1830	260	
	1900	270	
9/30	No well	defined	
10/1	Inver	sion	
10/2	0800	90	
	0830	110	
	0900	140	
	0930	130	
	1000	110	
	1030	120	
	1100	130	
	1130	140	
	1200	150	
	1230	140	
	1300	190	
	1330	120	
	1400	90	
	1430	100	
	1500	110	
	1530		
	1600	100	
	1630	110	
	1700	80	
	1730		
	1800		
	1830	220	
	1900	230	
	1930	220	
	2000	230	

DATE	TIME	Z(m)	
10/2	2030	240	
	2100		
	2130		
	2200	110	
	2230	140	
	2300	150	
	2330	130	
10/3	0000	120	
	0030	110	
	0100	90	
	0130	110	
	0200	100	
	0230	130	
	0300	140	
	0330	150	
	0400	170	
	0430	160	
	0500	120	
	0530	140	
	0600	120	
	0630	130	
	0700	140	
	0730	100	
	0800	90	

VIII. Meteorological Data

Table 6 presents the basic meteorological data and calculated parameters. Only data taken during the tracer gas release periods are included. Wind speed, relative humidity, and air temperature values are those measured at the upper level (20.5 m). All calculated parameters were determined using the bulk aerodynamic method.

The boundary layer mixing rate and mixing height depend on the boundary layer depth, Z_i. We have already mentioned the difficulty in determining the depth for these data. On the 28th and 29th we could not determine if the depth of the well-mixed region was 100 or 400 m, which makes the mixing rate and time calculations ambiguous. The results shown are self consistent.

Table 6. Meteorological Data

BLM #1-80
Release #1

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10↑3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
09/24 1137	2.1	73	14.7	16.6	330	0.073	0.075	107.0	-2.38E 00	0.4	14.0
09/24 1205	2.1	74	14.6	16.8	360	0.073	0.082	115.1	-2.55E 00	0.4	14.3
09/24 1233	2.0	73	14.9	16.9	350	0.068	0.075	107.5	-2.78E 00	0.4	14.9
09/24 1301	2.3	73	15.1	16.8	350	0.078	0.066	97.4	-1.91E 00	0.4	14.8
09/24 1329	1.9	72	15.0	16.9	340	0.065	0.073	105.9	-2.97E 00	0.4	14.9
09/24 1357	2.8	68	15.1	17.3	330	0.093	0.084	121.8	-1.67E 00	0.4	12.4
09/24 1425	3.9	70	15.2	17.3	300	0.131	0.075	108.5	-7.46E-01	0.5	10.8
09/24 1453	3.9	72	15.3	17.3	280	0.133	0.070	102.6	-6.87E-01	0.4	10.4
09/24 1521	3.6	71	15.2	17.3	260	0.123	0.075	108.7	-8.54E-01	0.4	10.0
09/24 1549	4.6	72	15.1	17.2	240	0.156	0.074	105.9	-5.13E-01	0.5	8.8
09/24 1617	5.9	76	15.0	17.1	250	0.206	0.071	98.8	-2.75E-01	0.5	8.3
09/24 1645	6.4	79	15.0	16.9	260	0.225	0.065	89.2	-2.09E-01	0.5	8.6
09/24 1713	5.8	76	14.8	16.8	270	0.200	0.068	94.5	-2.79E-01	0.5	9.0
09/24 1741	6.6	78	16.5	18.6	290	0.231	0.070	97.8	-2.17E-01	0.5	8.9
09/24 1809	7.0	79	14.8	16.7	290	0.243	0.061	25.1	-5.25E-02	0.5	9.2
09/24 1837	7.0	76	14.9	17.0	280	0.247	0.069	95.9	-1.86E-01	0.5	8.5
09/24 1905	6.8	77	14.8	16.9	280	0.239	0.071	97.4	-2.02E-01	0.5	8.5

BLM #1-80
Release #2

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10↑3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
09/27 0715	2.8	85	13.1	16.9	300	0.096	0.156	187.3	-2.39E 00	0.5	9.3
09/27 0743	2.8	87	12.9	16.9	250	0.096	0.164	194.5	-2.51E 00	0.5	8.2
09/27 0859	2.9	80	14.1	16.9	340	0.098	0.109	138.9	-1.71E 00	0.5	11.4
09/27 0945	4.6	78	14.5	17.0	200	0.156	0.087	115.3	-5.61E-01	0.5	7.4
09/27 1013	3.9	80	14.8	17.1	380	0.132	0.082	108.9	-7.44E-01	0.5	12.2
09/27 1041	4.1	80	15.0	17.1	400	0.138	0.076	103.0	-6.41E-01	0.5	12.7
09/27 1138	5.1	80	15.1	17.1	230	0.175	0.071	96.1	-3.71E-01	0.5	8.3
09/27 1206	5.1	82	14.8	17.2	220	0.175	0.084	109.2	-4.20E-01	0.5	7.6
09/27 1234	5.5	83	15.0	17.2	200	0.190	0.078	101.7	-3.35E-01	0.5	7.2
09/27 1302	5.9	82	15.0	17.2	220	0.207	0.075	98.8	-2.74E-01	0.5	7.5
09/27 1330	6.4	81	15.3	17.2	210	0.226	0.064	87.6	-2.04E-01	0.5	7.5
09/27 1358	6.6	77	15.5	17.1	200	0.229	0.054	79.7	-1.80E-01	0.4	7.6
09/27 1426	7.6	80	15.6	17.1	200	0.270	0.050	73.2	-1.19E-01	0.5	7.4
09/27 1454	8.3	77	15.8	17.2	180	0.298	0.042	66.3	-8.84E-02	0.4	7.0
09/27 1522	8.9	77	15.9	17.1	220	0.337	0.036	59.2	-6.18E-02	0.4	8.2
09/27 1550	8.0	75	16.2	17.1	230	0.284	0.025	48.4	-7.06E-02	0.4	10.0
09/27 1618	7.8	75	16.4	17.1	260	0.274	0.018	41.2	-6.45E-02	0.4	12.2
09/27 1646	7.9	77	16.4	17.0	290	0.277	0.017	38.3	-5.87E-02	0.4	13.3
09/27 1714	7.4	80	16.2	17.0	310	0.257	0.022	41.3	-7.37E-02	0.4	13.2
09/27 1742	8.0	80	16.0	17.0	140	0.282	0.028	48.5	-7.23E-02	0.3	6.9
09/27 1810	7.0	80	16.0	17.0	140	0.243	0.030	50.1	-1.00E-01	0.3	7.2
09/27 1838	5.8	80	15.9	16.9	160	0.200	0.029	49.6	-1.47E-01	0.3	8.4
09/27 1906	5.6	80	15.9	16.9	160	0.192	0.029	49.3	-1.58E-01	0.3	8.5

BLM #1-80
Release #3

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10↑3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
09/28 1307	2.0	81	15.8	17.1	210	0.067	0.045	68.0	-1.77E 00	0.3	12.6
09/28 1335	2.3	81	15.9	17.2	200	0.076	0.046	70.0	-1.43E 00	0.3	11.6
09/28 1408	2.9	81	16.0	17.3	160	0.094	0.046	69.1	-9.35E-01	0.3	9.3
09/28 1436	2.5	82	16.1	18.1	160	0.084	0.077	104.0	-1.74E 00	0.3	8.1
09/28 1504	3.0	83	16.2	18.0	400	0.100	0.065	90.5	-1.08E 00	0.4	15.0
09/28 1532	3.5	83	16.4	18.1	120	0.116	0.060	84.3	-7.41E-01	0.3	6.5
09/28 1600	3.4	81	16.6	18.0	140	0.111	0.046	70.1	-6.72E-01	0.3	8.0
09/28 1628	3.3	80	16.8	17.8	140	0.106	0.029	50.8	-5.32E-01	0.2	9.6
09/28 1740	3.1	80	16.9	17.8	400	0.102	0.029	51.1	-5.82E-01	0.3	19.5
09/28 1808	3.5	80	16.8	17.8	110	0.114	0.030	53.3	-4.85E-01	0.2	7.8
09/28 1836	2.7	81	16.6	17.6	400	0.088	0.031	52.9	-8.08E-01	0.3	20.0
09/28 1904	2.3	81	16.6	17.5	400	0.075	0.032	54.5	-1.15E 00	0.3	20.8

BLM #1-80
Release #4

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10↑3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
09/29 1217	2.4	80	13.8	16.1	100	0.079	0.090	117.0	-2.20E 00	0.3	5.8
09/29 1245	2.2	78	14.6	16.1	400	0.072	0.052	76.9	-1.76E 00	0.4	18.0
09/29 1319	2.7	76	15.4	16.2	440	0.087	0.027	50.3	-7.80E-01	0.3	22.5
09/29 1347	3.3	76	15.6	16.3	400	0.106	0.024	46.4	-4.85E-01	0.3	20.6
09/29 1415	3.5	76	15.7	16.5	430	0.114	0.024	46.7	-4.26E-01	0.3	21.1
09/29 1443	4.0	76	15.9	16.6	440	0.129	0.018	40.5	-2.85E-01	0.3	22.3
09/29 1511	4.7	76	16.1	16.3	410	0.154	0.000	19.5	-9.64E-02	0.1	91.9
09/29 1540	5.5	76	16.1	15.9	360	0.179	-0.011	6.6	-2.32E-02	0.3	20.8
09/29 1626	4.8	76	16.0	16.0	300	0.154	-0.006	11.9	-5.76E-02	0.2	23.3
09/29 1654	4.6	76	16.1	16.0	320	0.149	-0.008	10.0	-5.17E-02	0.2	22.7
09/29 1722	4.9	76	16.0	16.1	310	0.162	-0.002	17.3	-7.72E-02	0.1	37.5
09/29 1750	5.4	76	15.9	16.1	320	0.180	0.002	21.8	-7.87E-02	0.2	31.4
09/29 1818	5.1	76	15.8	16.0	280	0.169	0.002	20.9	-8.62E-02	0.1	32.5
09/29 1846	4.5	76	15.7	15.9	260	0.146	0.003	22.0	-1.20E-01	0.2	28.1
09/29 1902	4.3	76	15.8	15.9	280	0.137	-0.001	18.0	-1.13E-01	0.1	50.2

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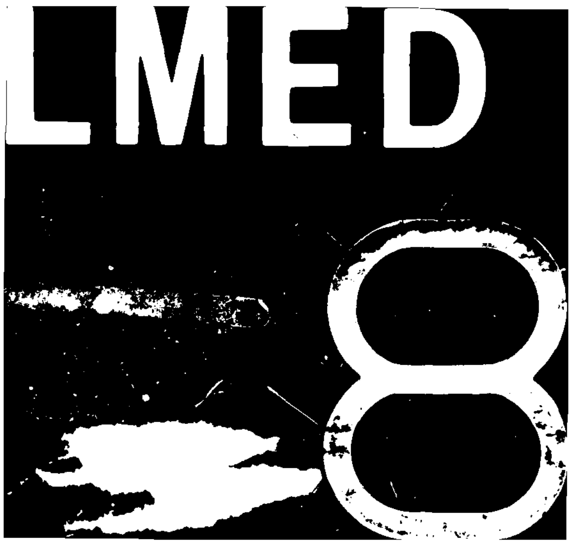
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